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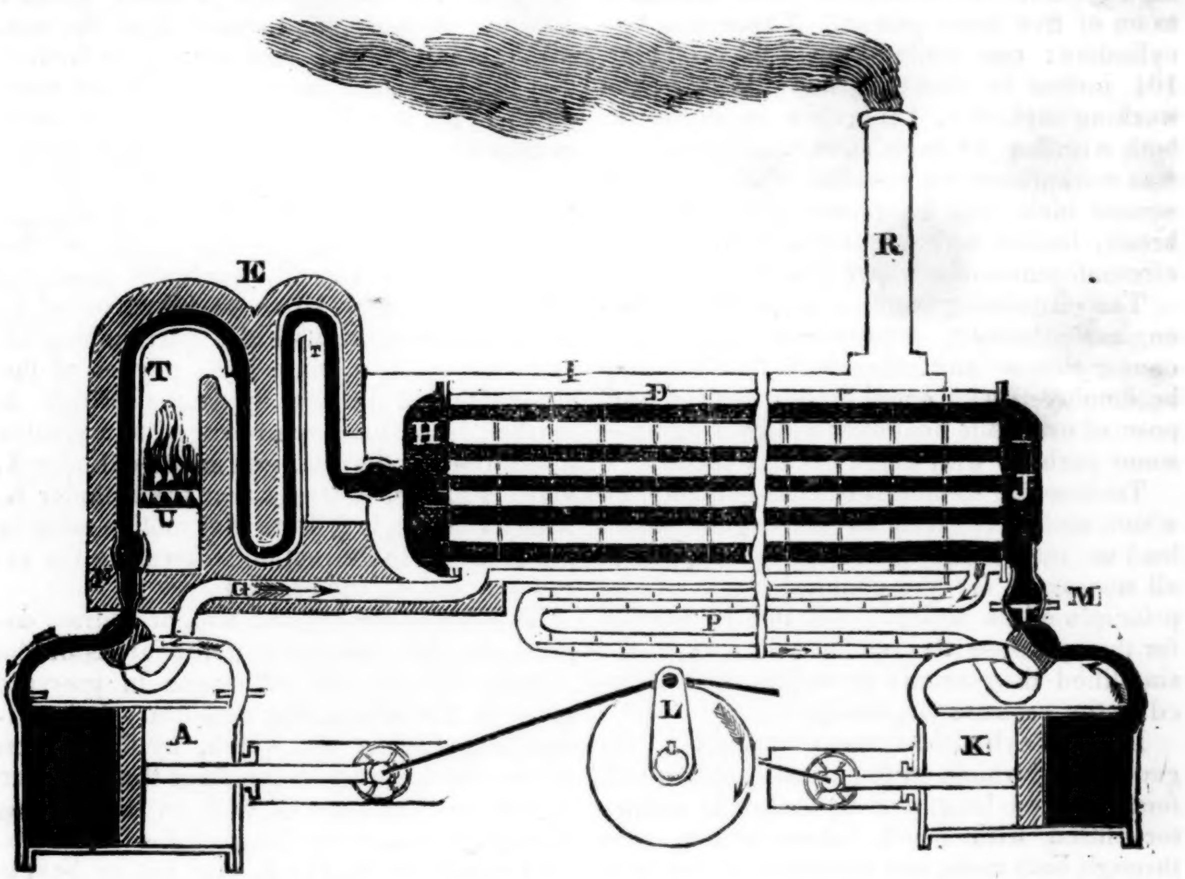
When we reflect that *heat* is the great agent in numberless important processes of chemistry and domestic economy, and is the actuating principle of the mighty steam engine which now performs half the work of society, how truly may heat be considered as the life or soul of the universe.—DR. ARNOTT.



ERICSSON'S CALORIC ENGINE.—In our number for December we promised a description of Mr. Ericsson's Caloric Engine as soon as it could be procured. We have much satisfaction in being thus early able to redeem that pledge. The following is from the London Mechanics' Magazine :

The susceptibility for heat, possessed by gaseous and fluid bodies, is known to be nearly unlimited. Neither density nor pressure seems to exercise the smallest counteracting influence. The densest medium will take up a given quantity of heat with as much facility as the rarest ; and when two mediums of unequal temperatures are brought in contact, they become equalized immediately, no matter how different their densities may be.

We have now to direct the attention of our readers to a mode of applying these physical truths to the production of mechanical power, which seems to us to be not only decidedly novel, but to be fraught with results of the greatest public importance.

We allude to the patent recently taken out by Mr. Ericsson, for what he calls his "Caloric Engine." The grand feature by

which this engine is distinguished from the steam engine, and all other power machines, is this, that the same given quantity of heat which sets it in motion is used over and over again to keep up that motion, and that no additional supply is wanted beyond what is requisite to compensate for a small loss incurred by escape and radiation.

We have seen, as well as hundreds of others, during the past week, an engine constructed on this plan actually at work, and can bear our personal testimony to its working as powerfully and equably as any steam engine could do.

The engine which we saw at work is, in all external respects, saving only the small space which it occupies, exactly similar to a high pressure steam engine. It is calculated to be of five horse power. There are two cylinders: one called the cold cylinder, 10¼ inches in diameter, and the other the working cylinder, 14 inches in diameter, both with an 18 inch stroke. The engine was worked under a pressure of 35 lbs. to the square inch, and its power checked by a break, loaded with 4,000 lbs., acting on the circumference of a wheel of 2 feet diameter.

The circulating medium employed in this engine is simply atmospheric air; but of course that or any other fluid medium may be employed with equal facility for the purpose of using the heat over and over again—some perhaps with much greater facility.

To describe the interior arrangements, by which motion is given to the engine, would lead us into a multiplicity of details, not at all necessary for the comprehension of the principle of its action. All that is needful for this purpose the reader will find in the simplified diagramatic arrangement exhibited in the prefixed engraving.

D D is a cylindrical vessel termed the "regenerator," which, in the actual engine, is 7 feet 6 inches long, and 8½ inches in diameter, fitted with small tubes, which pass through both ends, and terminate in the caps H and J. It also contains a number of division plates, through which these tubes pass, and which plates have segments cut out alternately from their tops and bottoms. The tubes themselves likewise contain a number of small divisions, tapering off towards the centre, each placed in an opposite direction to the other. T T is one of a series of bent tubes, inclosed in a stove, E, and acted upon by the fire, U, the combustion being supported by the draft produced by a chimney, R. The pipes in the stove are all connected with two larger pipes, the one of which communicates with the cap, H, and the other, as shown by the diagram, communicates with a four-way cock, attached to the passage-pieces of a cylinder, A, which is the working cylinder of the engine. P represents one or more pipes, exposed to some cooling medium, and is termed the "cooler;" it contains also a number of division plates, similar to those in the tubes of the regenerator, as also with the four-way cock attached to the cylinder K.

The whole of the apparatus, namely, the body of the regenerator, its tubes, the caps H and J, the pipes in the stove, the cooler P, pipe G, and the two cylinders, with their passage-pieces, we will now suppose to be all charged with common air, or any other æriform substance. We will suppose also that the portion of that air which is marked black in the diagram is kept under greater pressure or more compressed than the rest, which is left blank. Let us suppose farther, that the air which the cylinder A, the stove pipes T, the cap H, and the pipe G, contain, is raised to some considerable temperature, and that the air contained in the body, as well as the air in the tubes of the regenerator, is nearly of the same temperature of that nearest to the cap H, gradually lessening towards the cap J, so as to be there of an equal temperature with the surrounding atmosphere. Now, since that portion of the air contained in the apparatus which is marked black has been changed to a greater pressure than the rest, and as the cylinder A, with its piston, is larger than the cylinder K, with its piston, it follows that motion must be produced in the direction shown by the arrow marked on the crank L.

The force thus exerted will, of course, depend on the difference of the areas of the pistons, and on the difference in pressure given to the circulating medium. It is evident that the hot air, which, by the motion of the piston, must escape from the cylinder A through the pipe G, will, in its winding passage through the body of the regenerator towards the cooler P, give out its heat to the cold air forced from the cylinder K, the particles of the latter being also in a constant state of change in passing through the tubes towards the stove pipes. The pistons having performed the full stroke, the two four-way cocks are then reversed, when a retrograde action takes place; the motion of the opposite currents in the regenerator still continuing the same as before. A constant motion will thus be produced, and a constant transfer of heat kept up. The object of the cooler P is to abstract the heat, which, on account of the different capacities for heat of the two currents, is not taken up in the regenerator, and the object of the stove is to

supply the heat thus carried away, as well as to compensate for losses by radiation, and to raise the temperature at the commencement.

It need hardly be stated that the lesser volume of air coming from the cold cylinder fills the larger space in the hot cylinder, because it gets heated in passing through the regenerator and through the stove; while on the other hand, the larger escaping volume from the hot cylinder finds room in the lesser space of the cold cylinder, because it parts with its heat before getting there.

By charging the apparatus, the circulating medium may, of course, be kept under any desirable pressure, and thus the power of the engine varied at pleasure. High pressure will naturally produce the greatest proportionate effect, the loss by radiation being the same under whatever pressure.

We were anxious to satisfy ourselves as to the equality of the action of the engine, and with this view timed it repeatedly: the number of strokes was regularly 56 per minute.

The total consumption of fuel, when the engine is working at this rate, is stated to be no more than two pounds per horse power in the hour; and the entire loss of heat incurred by the transferring process (that is, the whole heat carried away by the cooler,) is estimated not to exceed the product of 3 lbs. of fuel per hour. That the fuel required is not even less than two pounds, is solely owing to the great radiating surfaces unavoidable in an engine on a small scale, and to these radiating surfaces not having in the trial engine been covered by any non-conducting substances.

Mr. Ericsson has published a pamphlet explanatory of the principle and construction of his caloric engine. We extract from it the following additional information:

"By keeping the pipes in the regenerator so charged with air as to support a column of mercury 56 inches high, the greatest effect is produced in the trial engine. By the manner in which the side-valves are worked, the pressure in the body of the regenerator always adjusts itself, so as to support a column of mercury 18 inches high; so that an effective pressure, equal to 38 inches of mercury, is kept up. A break, well oiled and loaded, with 5,000 lbs. weight acting on the circumference of a wheel of two feet diameter, fixed on the fly wheel shaft, will at the above pressure keep the speed of the engine at 55 revolutions per minute. At this speed, 176 cubic feet of heated air, of a mean pressure of 17 lbs. to the square inch, are admitted into the working cylinder per minute, thereby exerting a force equal to 431,970 lbs. moved through the space of one foot: thus $\frac{431\cdot970}{33\cdot000} = 13$ horses' power are communicated to the main crank of the engine. The estimating this power is, however, of no other use than to give an idea of the amount of friction to which the crank-engine is subjected. In the same space of time, or a minute, 94·6 cubic feet of cold air, of a mean resistance of 14 lbs. to the square inch, are forced or put into circulation by the cold cylinder, and equal to a resistance of 190,575 lbs. moved through the space of one foot. This amount, divided by 33,000, will give 5·7 horses' power required to work the cold cylinder—hence the two cranks give and receive the power of upwards of 18 horses. By communicating the power of the hot cylinder to the cold cylinder in a direct manner, the available power, setting frictions aside, would be 431,970—190,575=241,395 lbs. moved through the space of one foot. This is equal to $\frac{241\cdot395}{33\cdot000} = 7\cdot3$ horses' power—deducting 2·3 horses for frictions would leave 5 horses. On these grounds the trial engine has been estimated at 5 horses' power. The transferring process has succeeded to such an extent, that out of the 10 lbs. of fuel which the engine consumes per hour, the product of heat from 3 lbs. of fuel only are wasted or carried away by the cooler. This important fact has been ascertained by immersing the cooler in a cistern containing precisely 1081 lbs. of water, and by observing the elevation of temperature after an hour's work of the engine; and the increase of temperature in that time is not quite 20 degrees—one pound's weight of fuel being capable of raising the temperature of 9,000 lbs. of water, it follows that the 1081 lbs. contained in the cistern would be raised 8·3 degrees by the combustion of 1 lb. of fuel, and hence that the actual increase of 20 degrees of temperature is effected by the combustion of less than 3 lbs. of fuel. The great discrepancy between the quantity of fuel thus wasted, and that actually consumed by the engine, must be accounted for by the fact, that a considerable extent of radiating surfaces are exposed to the cooling influence of the atmosphere without being surrounded by any imperfect conductors."

Further Experiments on the Liverpool and Manchester Railway, to determine the correctness of the Undulating Railway System. [From the London Mechanics' Magazine.]

Sir,—Since I had last the pleasure of addressing you, we have been enabled to try some further experiments on the Liverpool and Manchester railway, the decisive result of which will, I doubt not, fully establish, in your mind and in the public opinion, the merits of the undulating principle.

On Wednesday last, the 16th instant, we met as before on *the Sutton inclined plane.* On this occasion it was agreed by the engineers present, viz. Mr. Robert Stephenson, sen., the Messrs. Dixons, Mr. Dagleish, and myself, that the truth and validity of the principle, as well as the comparative advantage to be derived from its adoption, would be effectually determined by the following test:

As great a velocity as possible being attained by the engine and load, before reaching a *given point* near the foot of the inclined plane, the *time* was to be *accurately* ascertained which the train occupied in *ascending from that point to a state of rest.*

The power being thus reversed, the time was to be accurately measured which the train occupied in *descending from a state of rest to the point* from which it had previously *ascended.*

Hence it would be obvious, that if the *descent* were made in less time than the *ascent,* the velocity generated at the foot of the plane would be proportionably greater than the velocity of the ascending train at the same point, and, consequently, the demonstration would be clear that the engine and train would not only have ascended to an opposite elevation equal to that from whence it fell, but to a *greater one,* the extent of which would be in proportion to the velocity attained.

Experiment 1.—The "Liver" engine, and a load of thirteen waggons (weighing in all $72\frac{1}{2}$ tons,) after traversing a distance of three-fourths of a mile to acquire a sufficient velocity, ascended the inclined plane 278 yards, the time occupied in performing the ascent to a state of rest being 90 seconds, viz. velocity at foot of plane being about 12.60 miles per hour, and the average velocity about 6.30 miles per hour.

Experiment 2.—The *power being reversed,* the engine and train *descended* 278 *yards,* viz. from a state of rest to the point from which they had previously risen, in 50 *seconds.* The velocity at the foot of the plane being about 22.70 miles per hour—average velocity about 11.35 miles.

Experiment 3.—The engine and train having traversed $\frac{3}{4}$ mile to generate velocity, ascended to a state of rest, viz. about 278 yards in 75 seconds. Velocity at the foot of the plane being about 14.12 miles per hour—average velocity about 7.6 miles.

Experiment 4.—The power being reversed, the descent of 278 yards was accomplished in 40 seconds. Velocity at the foot of the plane being about 28.32 miles per hour—average velocity 14.16 miles.

Experiment 5.—The ascent of 278 yards was made in 80 seconds. Velocity at the foot of the plane being about 14.22 miles per hour—average velocity 7.11 miles per hour.

Experiment 6.—The descent of 278 yards was accomplished in 49 seconds. Velocity at the foot of the plane being about 23.22 miles per hour—average velocity about 11,61 miles per hour.

AVERAGE.

	Total spaces passed over to generate maximum velocity before ascending.	Times occupied in ascending 278 yards.
Experiment 1	1,320 yards	90 seconds.
Experiment 3	1,320 yards	75 seconds.
Experiment 5	1,320 yards	80 seconds.
Total	13,960 yards	245 seconds.
Average	1,320 yards	$81\frac{1}{3}$ seconds.

	Total spaces passed over in generating maximum velocity in descending.	Times occupied in descending 278 yards.
Experiment 2	278 yards	50 seconds.
Experiment 4	278 yards	40 seconds.
Experiment 6	278 yards	49 seconds.
Total	834 yards	139 seconds.
Average	278 yards	$46\frac{1}{3}$ seconds.

From the preceding statement it appears, that the utmost average maximum velocity which the Liver engine could attain on this occasion, at the foot of the plane, after traversing a distance of 1,320 yards, was about 13.926 miles an hour; by which means, the power being continued, she was enabled to ascend an inclination of 278 yards.

On the other hand, it appears that the same engine, with the same load, (the steam being kept up in every instance to a pressure of about 50 lbs. to the inch,) generated a velocity, after descending 278 yards, of about 24.488* miles per hour, evidently proving that the engine and train would not only have mounted another summit of equal elevation to that from whence it fell, but would, *at the highest point,* have been travelling at a velocity of more than ten miles an hour, with the full means of increasing that velocity to any desired extent over the succeeding undulations.

Although the preceding experiments had, to the satisfaction of all present, decided the superiority of the undulating principle, I was anxious to know the result of a trial with a *double load.* I therefore proposed (it being too late an hour on this occasion) to attain, on a future day, a a velocity of twenty miles an hour, with a double train of goods and two engines. I had, on several occasions, published my opinion of what that result would be, and I have now the satisfaction of adding the particulars of this important experiment, which, I need not say, *more than confirms* all my anticipations.

On Sunday morning last two locomotive engines, viz. the "Firefly" and the "Pluto," left Manchester with a train of loaded waggons, weighing 150 tons, exclusive of engines and tenders, the whole length of the train being about 155 *yards.*

On arriving at the Sutton inclined plane, it was determined to adopt the same method as on the last trials, of proving the merits of the principle. Our reason for appointing Sunday for this meeting will be obvious, when it is considered how dangerous and inconvenient it would be to try experiments with such a load on any

* The velocity in these instances is calculated from the *average* number of seconds occupied in ascending and descending; thus, 278 yards being = about $6\frac{1}{3}$ of a mile, we have the descending line $46\frac{1}{3} \times 6\frac{1}{3} = 294$, and 3,600 seconds $\div\ 294 \times 2 = 24.488$ maximum velocity.

other day, when the trains are almost constantly passing and repassing.

It may be known to some of your readers, that the French government have lately appointed a certain number of their most eminent engineers to visit this country, with a view of acquiring all requisite information, preparatory to the construction of several intended French lines of railway.

These gentlemen, nine in number, were present on this occasion; their names were as follows—Mons. Navier; Mons. Goubeau, Jugement des Ponts et Chausses; M. Arnollet, Ingenieur en chef du Ponts et Chausses, a Dijon; M. Engene Nuneann, Ingenieur des Ponts et Chausses, No. 1 Rue Castiglione, Paris; Mons. Dausse; Mons. L. L. Vallee, Ingenieur en chef des Ponts et Chausses; Mons. J. Moistard, Ingenieur de la Marine; Mons. Paris, Lieutenant de Vaisseau; Mons. K. Mamgan.

The English engineers present were Mr. R. Stephenson, sen., of Manchester, (with whom I have recently entered into partnership as civil engineers,) Mr. Dagleish, sen., Mr. Dixon, sen., Mr. Dagleish, jun., and myself. In addition to whom were many other individuals deeply interested in railways, and of general scientific acquirements, among whom were Mr. Case, of Summer-hill, near Liverpool, Mr. Garnett, of Manchester (editor of the *Guardian*), and others.

The following statement cannot fail to form an interesting part of your publication:

Experiment 1.—Two locomotive engines, the Firefly and the Pluto, being attached to the train above mentioned, and having traversed a distance of *one mile*, to generate a sufficient velocity, arrived at the point from whence the ascent was to be measured, at a velocity of about 20.28 miles per hour. The Pluto then left the train, and the Firefly alone ascended with the load (working the whole way) to a distance of 575 *yards*, 116 *seconds*—average velocity being about 10.14 miles an hour.

Experiment 2.—The power of the Firefly being reversed, the *engine and load* descended 575 *yards* in 74 *seconds*. The velocity at the foot of the plane being about 31.70 miles per hour—average velocity about 15.85 miles per hour.

Experiment 3.—The Firefly and Pluto having traversed the same distance as before, generated, at the foot of the plane, a velocity of about 14.34 miles per hour. The Pluto then left the train, and the Firefly and load ascended (power working) 315 *yards* in 90 *seconds*—average velocity about 7.17 miles per hour.

Experiment 4.—The power of the Firefly being reversed, the whole train descended 315 *yards* in 65 *seconds*. Maximum velocity 19.82—average velocity 9.91.

Experiment 5.—The same engines and load, working about 1½ miles to generate velocity, attained at the foot of the plane a velocity of about 18.32 miles an hour. The Pluto left as before, and the Firefly and load rose 457½ *yards* in 102½ *seconds*—average velocity about 9.16 miles per hour.

Experiment 6.—The Firefly and train descended 457½ *yards* in 80 *seconds*. Maximum velocity 23.22 miles per hour—average velocity 11.61.—N. B. In this instance some delay occurred in reversing the power, which will account for the comparative difference in time.

Throughout the whole of these experiments it will be seen the results were so much in favor of the undulating system, that it was evident a *far greater* load than 150 *tons* could be moved by the Firefly, at an average velocity of 15 miles per hour from one summit of a curve to another. The dip of inclination being about 1 in 99, and the total length of the undulation varying from 630 to 1,150 yards.

This led me to propose a further experiment, and I think I may safely add, that one more important in result was never before tried in any country.

Experiment 7.—The two engines, as before, attained at the foot of ascent a velocity of about 19.04 miles per hour. The Pluto then left the train, and, at the same moment, the Firefly SHUT OFF HER STEAM. The whole train then rose by *momentum alone* (the weight of the train, including engine and tender, being near 164 tons,) to the distance of 323 *yards* in 70 *seconds*—average velocity about 9.52 miles per hour.

Experiment 8, *and last*.—The Firefly and train descended 323 *yards* (power working) in 66 *seconds!* Velocity at foot of the plane being about 20.04 miles per hour—average velocity about 10.02 miles per hour.

Thus the preceding experiments most unquestionably prove two most important facts—not only that a given locomotive power can convey from one summit of a curve or undulation, to another summit of equal altitude, *double the load* which that same power can convey at the same velocity on the level; but that a given locomotive engine can convey, from one summit of a curve or undulation to another summit of equal altitude, *double the load* which it is capable of moving on a level at a like velocity (see last experiment), *by the employment of the steam force throughout only half the distance!*

These results lead me to go *one step farther*. It is my opinion, that if such a weight were to be added to the 150 tons moved on this occasion, as would be a *maximum* load for *three locomotive engines* on a level at 15 miles an hour, the Firefly alone (her power being equal to either of the other engines) *would move* the whole train from one summit of a curve to another of like altitude, at an equal average velocity, viz. 15 miles per hour.

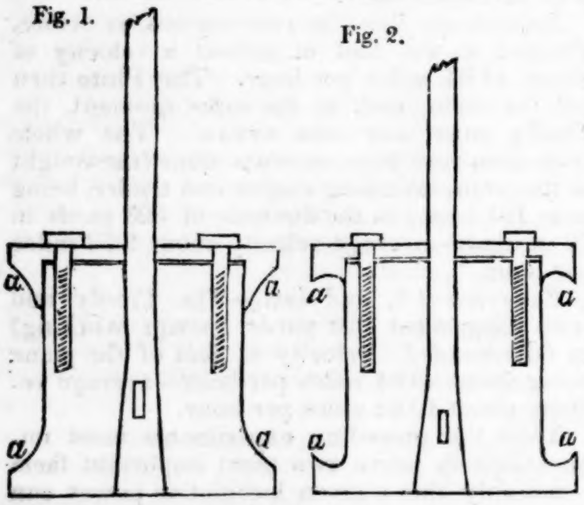
If any of your readers, whether witnesses or otherwise of these interesting experiments, can correct any error of opinion or of statement in allusion to them, I shall be exceedingly happy to recognize and acknowledge it. In the mean time I think, Sir, I may congratulate myself upon having stamped, by this letter, a value that will be long appreciated on the correspondence (*pro* and *con.*) which your Magazine contains on this subject; and I am as happy in feeling that every individual who witnessed the recent experiments was fully satisfied with the

importance of the results, as in believing that, in defiance of prejudice and long-formed erroneous opinions on this subject, the public will before long acknowledge, appreciate, and be benefitted by the "UNDULATING PRINCIPLE."

I am, sir, with great respect, your very obedient servant, RICHARD BADNALL.

P. S.—I have not yet seen your last Number. "S. Y.'s" remarks in the previous one shall be noticed. In the mean time, he does me injustice in supposing I have ever indulged one contemptuous feeling toward him. I could not indulge it to a worm—much more to an individual whose good motives, in a scientific discussion, I have never questioned, and in answer to whose remarks I have bestowed time, attention, and labor.

Fig. 1. Fig. 2.



Improved Method of Packing Pistons. By T. B. S. To the Editor of the Mechanics' Magazine.

Knowing that many of your readers take a lively interest in whatever contributes to the perfection of the means by which the mighty energies of steam are directed in channels of usefulness, I submit a brief description of an improvement in a minute though an important part of the steam engine. Many expedients have been devised to avoid the use of hemp for the packing of the piston ; various metallic substances have been substituted, and numberless other materials long since condemned after repeated trials.

While the piston as adopted by the ingenious Mr. Watt continues in almost universal use, and until a cheap and more enduring piston is discovered, it will doubtless continue to be the favorite plan. In one of its features, however, I consider it susceptible of improvement.

Heretofore engineers have considered it important to form the projecting parts of the piston and follower so as to crowd the hemp outward against the cylinder, as the follower is screwed down to its place. The sketch, fig. 1, is about the form usually given to the metallic part of the piston, and shows the form of the recess for the reception of the packing. It is apparent that the obtuseness of the corners at *a, a, a, a,* are well calculated to avoid the packing as it becomes chafed by friction against the cylinder, while the general shape of the recess greatly conduces to an excessive friction near those angles. Fig. 2 represents the improved form of the piston as I have applied it in several instances, and with success. The acuteness of the edges, *a, a, a, a,* is calculated to preserve the packing from chafing, to hold it in a body to its place, and will retain it, even though worn to fragments, or otherwise reduced, as it may be liable from a variety of causes. Most of the engines in use have pistons of the former description, and the experiment may be tried with a trifling expense, simply by turning a cavity as near to the form of that in fig. 2 as the substance of the piston will allow.

In the hope that some may derive a benefit from the suggestions, as well as to contribute a mite to the interest of your valuable periodical, I offer them.

I am, yours, &c. T. B. S.

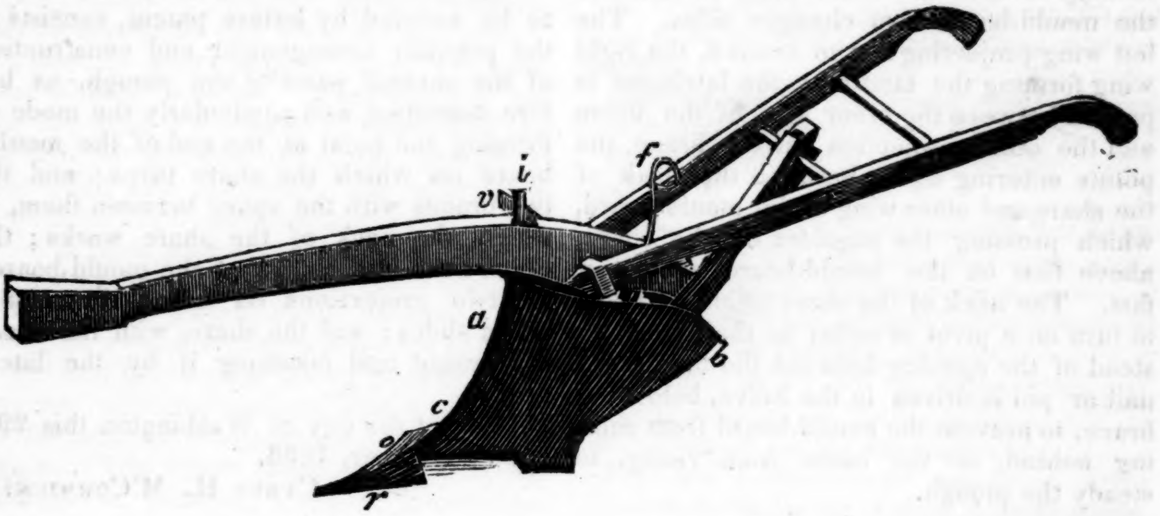
New-York, Jan. 24, 1834.

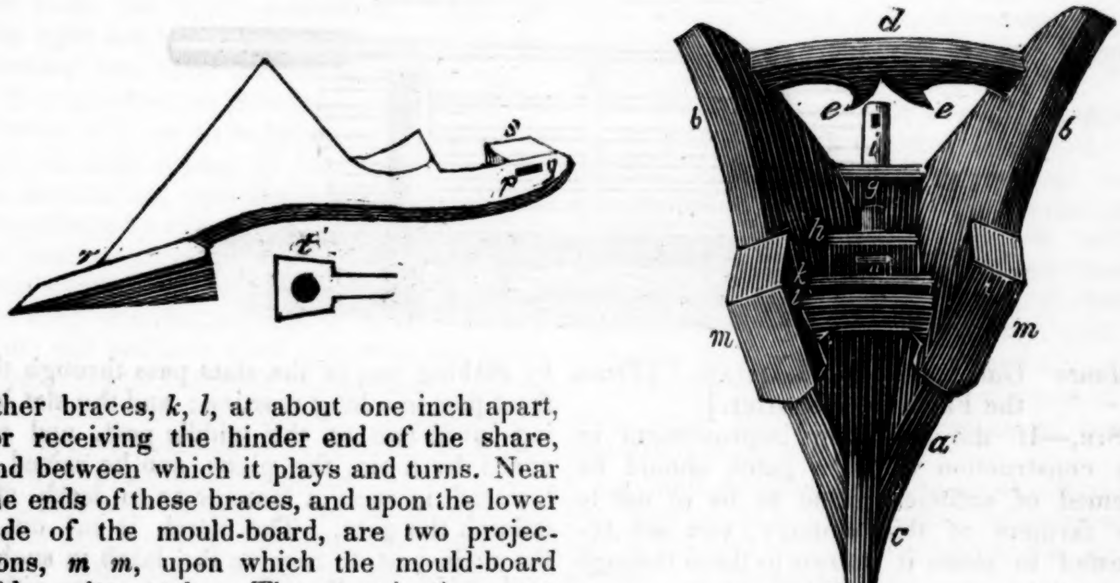
C. H. M'Cormick's Self-Sharpening Horizontal Plough. [Communicated by the Inventor for the Mechanics' Magazine.]

Be it known, that I, Cyrus H. M'Cormick, of Rockbridge county, and State of Virginia, have made an improvement in the useful arts, being a "self-sharpening horizontal plough," which is described as follows :

This plough, like most others, consists of a beam, handles, helve, mould-board, and share. In addition to these there is a latch-rod to make fast the mould-board and share, when changed to either side, and a main bolt to support the mould-board.

The beam, handles, and helve, are similar to those employed in other ploughs. The mould-board, represented at *a* in the annexed drawings, is made double, of cast iron, curved somewhat like other mould-boards, on both sides. The wings, *b b*, are united in part at *c*, and extend outward, making a suitable angle for turning over the earth. There is a brace, *d*, extending between the two wings, behind, supporting them firmly with projections, *e e*, on one side, for receiving the latch-rod, *f*, when changing the plough. Between the wings on the top, and near the front, is a brace, *g*, and another, *h*, near the middle, through which there are openings for the main bolts, *i*, to pass. Near the bottom of the mould-board are two





other braces, *k*, *l*, at about one inch apart, for receiving the hinder end of the share, and between which it plays and turns. Near the ends of these braces, and upon the lower side of the mould-board, are two projections, *m m*, upon which the mould-board slides alternately. These projections can either be cast solid, with the mould-board, or be made of steel or cast iron, and be rivetted on. These projections serve also to hold and support the share when turned. At the front end of the mould-board is cast on it a projection, *n*, which serves as a pivot, on which the share turns.

The share, *o*, is made of cast or wrought iron, in a triangular shape. It consists of the neck, *p*, (with or without a head,) and a slat, *g*, for a key, placed behind the braces; also, a point, *r*, either cast on the share or made separately, and fastened on it by being rivetted, or otherwise.

There is also a shoulder, or projection, *s*, by means of which and the latch-rod the share is kept in its place when changed. In the hinder end of the point is a cavity, *t*, to admit the point on the mould-board, upon which and the neck the share turns.

The *main bolt*, *i*, is made of wrought iron, and passes through the beam, and the two openings in the braces of the mould-board before mentioned having a head, *u*, on the lower end, and either a screw or key, *v*, on the head above the beam.

The *latch-rod*, *f*, is a plain curved rod of wrought iron, which extends from above the beam to the neck of the share, and is moveable from one side of the beam and mould-board to the other, passing between the beam and the projections on the brace of the mould-board, and entering between the neck of the share and the wing of the mould-board, and by which the mould-board and share are screwed in the position required.

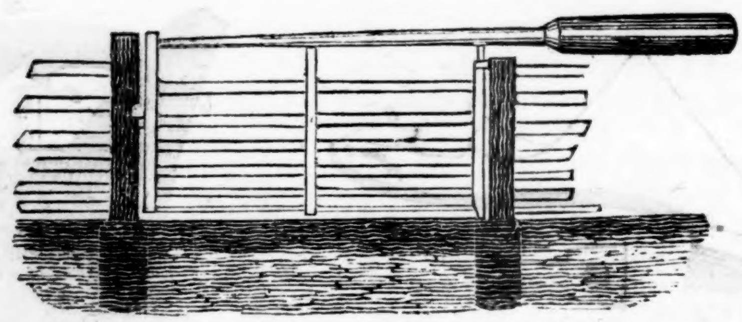
Operation.—When required to plough on a hill-side, say the declination of the hill is on the right, the right wing of the mould-board and share must stand out from the beam to the right, and the other wing of the mould-board being nearly parallel with the beam, forms the land-side, the latch-rod being put in its proper place. One furrow being made in this position, the latch-rod is taken out, and turning the plough, resting on the share, the share is turned on the point of the

mould-board, to the other side, or left, and the mould-board also changes sides. The left wing projecting out to the left, the right wing forming the land-side, the latch-rod is passed between the other side of the beam and the other projection on the brace, the points entering again between the neck of the share and other wing of the mould-board, which pressing the shoulder on the share, above that on the mould-board, makes it fast. The neck of the share might be made to turn on a pivot or collar on the centre, instead of the opening between the braces. A nail or pin is driven in the helve, below the brace, to prevent the mould-board from sinking behind, or the beam from rising, to steady the plough.

The invention here claimed, and desired to be secured by letters patent, consists in the peculiar arrangement and construction of the several parts of the plough, as before described, and particularly the mode of forming the point at the end of the mould-board on which the share turns; and the two braces with the space between them, in which the neck of the share works; the brace near the centre of the mould-board; the two projections on which the mould-board slides; and the share, with the mode of turning and fastening it by the latch-rod.

Done at the city of Washington this 29th day of October, 1833.

CYRUS H. M'CORMICK.



Balance Gate. By D. LAPHAM. [From the Farmers' Reporter.]

SIR,—If the following improvement in the construction of farm gates should be deemed of sufficient value to be of use to the farmers of this country, you are requested to make it known to them through the medium of your valuable paper.

This gate consists of two main posts, set firmly in the ground at the proper distance asunder, in the line of the fence; that part which is above the ground is made about 12 inches square, and the lower part is left round, forming a shoulder at the surface of the ground. These posts have mortices on the exterior sides to receive the rails of the fence. The gate itself is formed of three posts of scantling, 4 by 5 inches square, into which are framed about six strips of 1¼ inch boards, 4 inches wide, so as to form a rectangular gate of the length and height required. Upon the top of these posts rests a beam, which extends back far enough just to balance the gate. The heel-post, upon which the gate turns, rests upon the shoulder of the main post, at the surface of the ground, where there is a depression made to receive it, and it is secured at the top by a staple, or hoop of iron, passing around it, (the upper part of the post being rounded for that purpose,) and is fastened into the main post. The latch or fastening is formed by making one of the slats pass through the front post in a long mortice; and the slat being cut in two at the middle post, and secured by a pin, the piece can be raised or lowered in such a manner as to latch and unlatch the gate. The notch is cut out of the main post, to receive the latch in such a manner as to allow the gate to open either way. This gate is much neater, more substantial, and is less liable to get out of repair, than those formerly in use. There are two gates of this description on the farm where my father resides, in the north part of Champaign county, and he intends soon to have one to each of his fields. D. LAPHAM.

Cincinnati, Ohio, Dec. 19, 1833.

Observations on Architectural, Rural, Domestic, and other Improvements. By ELEAZAR LORD, of New-York. [From the American Journal of Science and Arts.]

NEW-YORK, July 23, 1833.

TO PROFESSOR SILLIMAN:

SIR,—I observed recently in one of the public prints, a brief notice of an association of gentlemen in your city, for the purpose of ascertaining and recommending the best plans and models of domiciliary architecture. The questions to be investigated relate, as near as I remember, to the architectural proportions, materials for building, and methods of warming and ventilating apartments, by

which durability, economy, and convenience, may be combined with elegance and taste.*

These, in every point of view, are questions of great interest. They concern not only the thrift and comfort of individuals and families, but likewise the health, the social character, and indirectly, the morals of households and communities; and considered in these relations, they are worthy of all the attention they can receive from enlightened and philanthropic citizens. It is matter of wonder that they have not hitherto gained that hold on the public mind to which they are entitled; and no less a matter of satisfaction, that they are now to receive notice in a city where there are so many advantages of location, scenery, knowledge, and taste, for their elucidation, combined with right notions of economy, and of all the means of individual and social well being.

But my object in thus taking the liberty to address you, is to suggest, on presumption that you take a part in the proceedings of the association, that the inquiries to be pursued should be extended to some other topics, not less essential to the main design than those which have been announced; or rather that they should commence at an earlier point, and embrace what relates to the kinds of soil on which human habitations ought to be erected, and the choice of localities for that purpose considered in relation to neighboring formations and objects.

Without pretending to do more than to glance at some of the most obvious heads of inquiry under this branch of the subject, I may illustrate what I have in view, by a brief statement of questions which require investigation.

1. What are the chief requisites in a site for a dwelling house?

What circumstances and advantages are desirable, considered simply in relation to the principal design and use of the building; and what, considered in relation to adjacent objects?

2. What descriptions of soil are proper for the sites of dwellings?

What soils are to be preferred for yards, gardens, and adjoining grounds?

What soils are objectionable on account of their natural composition, or their liability to excessive moisture, or other vicissitudes?

3. What kinds of earth are to be preferred for cellars, considered in respect to moisture, temperature, and effects, in different seasons, on vegetable substances, and on the air in the apartments above?

4. What objects in the vicinity are in all cases to be avoided? Among these may be specified:

Marshes and all permanent receptacles of decaying vegetable matter.

Grounds which are periodically overflowed.

Grounds which are excessively wet from ordinary rains during a portion of every year, and which exhibit extensive evaporation.

Ponds which are drained in the course of the summer or autumn; and other

Localities which are occasionally subject to great changes in their condition, and in their influence on the atmosphere.

5. What considerations are to be taken into view in the choice of sites in given cases, as of plains, valleys, hills, mountains, banks of rivers, exposure to winds and storms, particular geological formations?

6. What considerations are to be regarded, in given cases, respecting the depths of cellars, the elevation of the first floor from the level of the adjacent grounds, and the position, height, and form of houses, reference being had to the position of other dwellings, and to that of out-buildings, gardens, roads, streets, and distant scenery, and to exposure to winds, storms, cold, and heat?

7. What, with relation to dwellings and to each other, should be the position of barns and other out-buildings?

8. What cautions ought to be observed in the location and construction of dwellings and out-houses, to guard each and all of them against the hazard of fire?

9. What plans and measures are to be adopted respecting door-yards, courts, gardens, shrubbery, vines, and trees?

10. What is to be aimed at in respect to water for household use, and in what cases are pumps or aqueducts to be preferred to wells and fountains?

11. What plans and materials for fences are to be preferred?

12. What plans and materials are most eligible for walks, intended to be dry, durable, and tasteful?

These, and the like heads of inquiry, would give scope for the most valuable instruction and advice, applicable to every part of our country, and which would, one cannot doubt, be extensively well received, adopted, and carried into practical effect.

Of the thousands and tens of thousands who every year engage in the erection of dwellings, how few possess or are in any condition to obtain the knowledge which is needful to guide their judgments in respect to the most essential of the above particulars, or with a view either to economy, conve-

* Many other objects were embraced in the plan.—[ED.]

nience, durability, elegance, health, security from fire, effect on price, or any other advantage, private or public? In how many thousands of instances, even in localities which present, to an informed and observant eye, unobjectionable sites, are all these benefits lost, and great inconveniences and evils incurred for want of such hints and advices as might be comprised in a tract of a few pages? In numerous cases, both of single dwellings and of neighborhoods, it would seem that no one of these advantages could have been so much as aimed at, or taken into account; and what is, perhaps, somewhat more surprising, when a site has once been chosen and occupied, the most painful experience of its evils, the loss of health and of life itself, seldom causes it to be abandoned.

These observations might be illustrated by reference to insulated houses and to villages, and even cities. The public mind is not impressed with the considerations which ought to be had in view in the location of habitations; and in numberless cases, individuals blindly follow bad examples, or are determined by some whim, or some circumstance foreign to the real and permanent benefits, to secure which ought to be their object. Each one, especially in the country and new settlements, builds his house when, how, and where he pleases, as though his successors and the public had no concern with the matter, and as though the erection of a shelter for his family, in a position and by a process which should least interfere with his present convenience and employments, were all that behoved him to take into account.

Hence it is common to observe houses placed where they should not be, though in the immediate vicinity of eligible sites, while the barns and out-buildings are so near to them and to each other, as to be objectionable on many accounts, besides being all liable to be destroyed by fire in case of the burning of either of them. Houses are likewise frequently built in low and damp situations, where draining is impracticable, while the barns pertaining to them are placed where the dwellings should be, on dry and advantageous locations. In numerous instances, likewise, houses are to be observed, not only on the borders of ponds and marshes, but on the side of them which is opposite to that whence the prevailing wind proceeds.

It were easy to multiply references of this kind; but the subject demands more particular and thorough investigation, and it is of such general concernment that I should suppose the association, besides extending its field of inquiry, might well enlarge its plan in another respect, so as to procure corresponding members, or associations, in different parts of the country and of the world, to co-operate with the primary body, and to publish in your excellent Journal, and in the form of occasional tracts or otherwise, with drawings or cuts, the facts, principles, and advices, which such a combination of means would furnish, and which are so universally needed.

Such an association, branching itself out, and engaging the attention of numerous individuals, might exert a most salutary and effective influence, directly upon the subjects to be treated of, and through them on the health and enjoyments, and indeed on all the personal and social interests of man. That influence would be important in its connection with our moral and political economy, would essentially aid other reformations, would augment the resources of domestic interest and recreation, promote a taste for rural scenery and a love of excellence in every thing, add to the cheerfulness and beauty of dwellings, and prompt to the cultivation of the minds and hearts of their inmates. The bearing of such an influence on the subject of temperance, in very numerous instances of dwellings placed in unhealthy situations, is sufficiently obvious; and likewise its tendency to prevent indolence, pauperism and vice, and consequently to diminish the hazards and burdens which one portion of every community imposes on another and better portion. He who is neat and tasteful in and around his dwelling, will be likely to cultivate those qualities of mind and heart which such a state of things implies and requires; and will promote the same associations and habits in his family, and extend them to the literary, moral, and social education and conduct of his children. A portion of such families in each small community would, by their sentiments and example, raise the general standard of opinion and taste, and exalt these arrangements of elegance and comfort into rules of social observance, and requirements of decent propriety.

No such reformation, however, of the opinions, tastes, and habits of mankind, is to be hoped from individual or insulated effort. Reason and argument in such a case will be ineffectual, unless combined with personal and local influence. The threefold cord of association is the indispensable and only adequate instrument of success in an undertaking of this nature; and for the same reasons, even this instrument must be present and locally operative in every vicinage and community where its beneficial results are to be expected.

Nor is the design capable of being so easily or speedily accomplished in any way, as to render unnecessary an extensive organization. Though many of the most important suggestions to be made require no very labored investigation, and, among those who comprehend them, scarcely admit of two opinions; yet there are questions to be resolved respecting the location and structure of dwellings, almost as numerous as the varieties in the surface of the earth, and the wrong notions and habits of those who occupy it—questions which demand extensive inquiry and observation, and which will not be exhausted while any thing remains unknown of earth or air injurious to human health and happiness. The subject involves the physical nature, circumstances, and wants, of man, and in no slight degree his welfare as a rational, social, and accountable being; it has an important relation to his plans, employments, and success in life, and, indeed, to his whole history; it is to be studied in all its relations to nature and art, its relations to what is uniform and unalterable in the earth, to the various changes which are taking place in the surface, to various local peculiarities, to the increase and decay of vegetable matter, and the neglect or progress of cultivation, to changes in the course and deposits of streams, to the condition of natural and artificial collections of water, to climate, and to the long catalogue of local, periodical, and epidemic diseases.

A general reformation of the opinions and tastes of mankind, in respect to this whole subject, is greatly to be desired as a means of temporal happiness. No small proportion of the self-procured and the hereditary misery and degeneracy of the race, proceeds from ignorance and neglect of what is every where practicable in relation to this subject.

Who that closely inspects the sites, plans, materials, and condition, of all the habitations in any district of country, or in any town or city, and the character, habits, pecuniary circumstances, pursuits, recreations, and enjoyments, of their respective occupations, but must be forcibly struck with the powerful and discriminating effects of the causes which are involved in this field of inquiry? Who that traces the progress of an individual from his infancy in a mean, filthy, and ill situated abode, to one that is desirable for its location, structure, and other advantages, can fail to perceive the operation of these causes?

Of how many, both of the best and worst members of society, may it not be said, that the influence of such causes on their natural dispositions and tastes, determined their course above or below the level on which they started? I remember an anecdote, related to me by the late Rev. Dr. Strong, of his ancient preceptor, Dr. Bellamy, who, on parting with two of his pupils, by way of caution and advice to them, indicated, as what he had dreamed, his impressions, founded, no doubt, on what he had observed of their capacities, tastes, and habits, respecting their future career. The rising progress of one he traced to a thriving and beautiful parish, a handsome and commodious dwelling, and subsequent usefulness and honor. The other he followed from one thriftless and quarrelsome parish to another, till he reached the poorest and most desolate section of New-England. He afterwards visited the first at his residence in Hartford, and the other in a wretched tenement, surrounded by ragged children, in a parish which could boast only of such a minister, with no meeting-house, no school, and scarce a single entire glass window.

But there are other and far more important consequences to be looked for, than those which relate merely to temporal comfort and prosperity: consequences which involve the intellectual and immortal interests of men. And in that improved and cultivated state of society which the scriptures teach us to expect, when the present causes and occasions of degradation and sorrow will be resisted and overcome, when the evils we endure will be obviated by the Divine blessing on a wise and proper exertion of our faculties, this reformation will be universal and complete.

There is, then, every encouragement of growing and ultimate success to cheer those whose part it is to promote this object. And there surely are not wanting those in every place who by their education and circumstances are qualified to take a part in it, and who by a common effort may soon do much for its advancement.

Let such fancy to themselves a town or village in a location free from all material objections, and possessing every essential advantage, and laid out and built in such a manner as to secure all the objects, public and private, which are desirable; let it be supposed that the benefits of such an arrangement are appreciated by the inhabitants, and that they agree in their tastes and opinions on this subject; and can there be any more doubt of the good effect of such a state of things on all the interests, character, and welfare of the families concerned, than of the actual difference between the worst

and best sites, buildings, and occupants, in towns as they now exist?

Let them also consider what evils might be easily obviated, and what benefits secured, in their own immediate neighborhoods, by the improvements which attention to this subject would suggest; and to what more useful or creditable purpose their talents, knowledge, and leisure, can be applied.

The subject may fitly be commended to the attention of lyceums and other existing institutions in different parts of the country, with particular reference to their respective localities.

With great regard, I remain your obedient servant, ELEAZAR LORD.

DR. JEFFREY'S APHORISMS.—Let the day begin with God—that the peaceful influence of communion with him may calm the hurried and tumultuous action of the body, in the performance of its daily avocations.

Let the early fast be broken by no more food than will defend the body from severe exhaustion, in the labor or pursuit which is to follow.

Let the exercise or labor which is performed be in faithful accordance with the injunction, that the food should be earned by the sweat of the brow.

Let the principal food taken be at a time when it shall repair the parts and powers which have been consumed by previous exertion of body, or of mind, rather than in anticipation of such decay or waste; so that the body shall not suffer from the increased effort of severe digestion, while it is pushed to labor: and the mind may not be cramped in its energies by a crowded system.

Let the sleep be regularly taken, and religiously observed to such extent as shall restore the nervous energy of the frame; but let not the bed rob God or man of the service of one hour which belongs to them. To this end, seek rather to ascertain by experience how little will fully suffice the requirements of the system, than how much it can safely bear.

Let the clothing be designed to cover, rather than to adorn the person; and let it be only so much in quantity as will defend the body from inclemency, and not to such extent as will enfeeble its powers. Seek rather to inure the body to climate, than to defend it entirely from the influence of cold or heat.

Let the person be kept sacredly clean, lest the body become infected from the want of ablution, or the mind become defiled by the consciousness of an impure temple: for

> 'Even from the body's purity, the mind
> Receives a secret sympathetic aid.'

Let a holy chastity mark the conduct and the conversation in every relation of life—lest the frame should become enervated from undue bodily or mental excitement.—[American Quarterly Observer.]

SUDDEN EFFECTS OF THE MIND UPON THE BODY.—Plato used to say that all the diseases of the body proceed from the soul. Says Mr. Weld, in his famous report,—The expression of the countenance is mind invisible. Bad news weakens the action of the heart, destroys appetite, oppresses the lungs, stops digestion, and partially suspends all the functions of the system. An emotion of shame flushes the face, fear blanches it, joy illuminates it; an instant thrill electrifies a million nerves. Surprise spurs the pulse into a gallop. Delirium infuses giant energy, volution commands and hundreds of muscles spring to execute. Powerful emotion often kills the body at a stroke. The news of a defeat killed Philip V. One of the Popes died of an emotion on seeing his pet monkey robed in pontificals and occupying the chair of state. Muley Moloch was carried upon the field of battle in the last stages of incurable disease; upon seeing his army give way, he leaped from the litter, rallied his panic-stricken troops, rolled back the tide of battle, shouted victory, and died. The door-keeper of the Congress of the United States expired upon hearing the surrender of Cornwallis. Eminent public speakers have often died, either in the midst of an impassioned burst of eloquence, or when the deep emotion to produce it had suddenly subsided. The recent case of Hills, in this city, is fresh in the memory of all. He was apprehended on a charge of stealing goods from his employer, and taken before the police; though in perfect health, mental agony forced the blood from his nostrils—he was carried out, and died.

BALD EAGLE.—Dr. Franklin's character of the Bald Eagle, and his preference of the Turkey as the national blazon:

"For my own part I wish the Bald Eagle had not been chosen as the representative of our country: he is a bird of bad moral character; he does not get his living honestly; you may have seen him perched on some dead tree, where, too lazy to fish for himself, he watches the labors of the fishing hawk, and when that diligent bird has at length taken a fish, and is bearing it to his nest for the support of his mate and young ones, the bald eagle pursues and takes it from him. With all this injustice he is never in good case, but, like those among men who live by sharping

and robbing, he is generally poor and very lousy. Besides, he is a rank coward; the little king-bird, not bigger than a sparrow, attacks him boldly, and drives him out of the district. He is therefore by no means a proper emblem for the brave and honest Cincinnati of America, who have driven all the king-birds from our country; though exactly fit for that order of knights whom the French call *chevaliers d'industrie*. I am on this account not displeased that the figure is not known as the bald eagle, but looks more like a turkey. For in truth, the turkey is, in comparison, a much more respectable bird, and withal a true original native of America. Eagles have been found in all countries, but the turkey was peculiar to ours. He is, besides, (though a little vain and silly, 'tis true, but not the worse emblem for that,) a bird of courage, and would not hesitate to attack a grenadier of the British Guards, who should presume to invade his farm-yard with a red coat on."

It is said that you cannot pluck, even by scalding, the feathers from the bald eagle. —[Westminster Review.]

On the Causes of Spontaneous Combustion. By J. A. B. [From the Journal of the Franklin Institute.]

I wish, through the medium of your Journal, to solicit the attention of some of your scientific readers to the causes of spontaneous combustion, generally; and with a view particularly to the investigation of those causes that are liable to produce it in cotton, woollen, and paper factories, from the stock, or waste, being accidentally impregnated with oils, or other substances.

As very few manufacturers are sufficiently acquainted with chemistry to determine accurately the causes of the effects which they may observe, it is therefore desirable that men of science, who have leisure, inclination, and information, (our correspondent has forgotten an important item, viz. *means*,) adequate to the task, should undertake and perform a series of experiments on the intermixture, or chemical combination, of different materials, together with the proportions, situations, degrees of heat, &c., requisite, in each case, to produce spontaneous combustion, and that publicity should be given to the same through the pages of this Journal.

The vast amount of capital invested in various kinds of manufactures, and the large number of mechanics and workmen of every grade and description, who are interested, either directly or indirectly, in the safety and prosperity of our factories, whose daily support and almost sole means of accumulating property are derived from their employment therein, all unite in the requisition.

It is confidently believed that many buildings have been destroyed by fire, originating in spontaneous combustion, and that there is frequently great danger, where it is least suspected.

To aid in the inquiry, agents and superintendents, as well as the observers in the several departments of factories, should unite in communicating such cases as may have come within their notice, together with such facts and circumstances as attended them.

To contribute my mite, I will give an account of the few instances that are within my knowledge, although my statements cannot be as detailed as I could wish, from my not having paid much attention to the subject at the time the observations were made.

The first instance of spontaneous combustion, or that which was apparently so, and was not otherwise accounted for, was in a quantity of wood ashes.

The ashes were in the body of an old waggon, with boards above, at the sides and ends, and had been accumulating for more than two years, to the amount of fifty bushels, or more. The ashes belonged to a very careful man, if the epithet is not altogether inapplicable to a person who would deposit ashes in a wooden vessel, whose constant custom was to have his ashes taken up from the hearth in a metallic vessel, and stand therein until entirely cold, before they were put into the usual place of deposit, and no danger was apprehended from this practice.

One evening about sunset, smoke was perceived to issue from the body of ashes, and it was first supposed that one of the domestics had, contrary to strict orders, put in some hot embers; but, on inquiry, it did not appear that any ashes had been added for three days, and this appeared the more probable, as several vessels were then found standing full of ashes which had been taken up.

When the fire was discovered, it was expected that it was confined to a small spot only, and that a small quantity of water would be sufficient to extinguish it, but, on pouring water on the mass, the ashes were scattered very extensively, and on further examination it was found that the boards in several places were burnt almost through, and that the whole quantity of ashes was in a state of ignition like embers immediately from the fire. Nothing but a timely discovery prevented the destruction of a large portion of a village, for the buildings were all of wood, and so situated that the chance of

saving one out of twenty would have been but very small.

I should be glad to throw some further light on this subject, but every thing else in relation to it was mere conjecture, and whether some oily substance was accidentally intermixed with the ashes, or was introduced by carelessness, or otherwise, or from what cause the combustion was produced, remains entirely unknown.

Instances have been known in which cotton has taken fire by wiping up with it oil that had been spilled, both linseed and sperm oil.

Weavers' harnesses in factories are varnished with a varnish made of the following materials, the same, in greater or less proportions, being used by different manufacturers: the usual ingredients are, linseed oil, spirits of turpentime, litharge, red lead, shellac, umber and India rubber. The composition is boiled down to a thick varnish, or laid on to the harness with a brush. The harness is usually made of cotton twine.

I once knew an instance in which a hank of twine, which was varnished for mending harness, took fire, spontaneously, while hanging to dry.

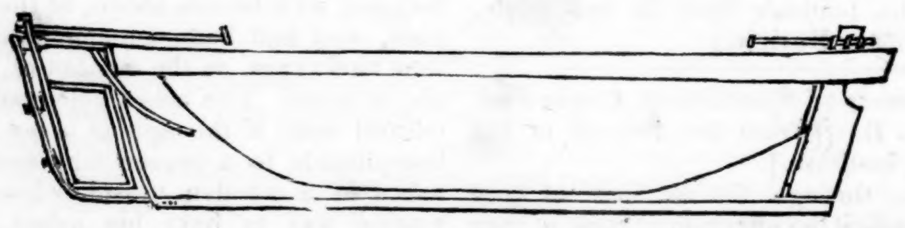
I mention this circumstance, because in many factories it is customary to varnish and hang the new harness to dry in the garret, or some other spare room of the mill, and likewise to lay away the old worn-out harness in the same place, and with very little caution as to the quantity that comes in contact: a practice that may lead to dangerous and destructive consequences.

I hope my remarks will not be considered irrelevant. It will readily be perceived that my object is, at this time, more to obtain than to communicate useful information.

Very respectfully, yours,

J. A. B.

Pittsfield, N. H., December 2, 1833.



A Bow Rudder. By W. Aldersey. [From the United Service Journal.]

The following plan is proposed for fixing and working a rudder at the bow of a vessel, to act in unison with the rudder at the stern, as calculated to embrace all the advantages proposed by that experienced and highly respectable officer in the East India Company's service, Capt. William Manning, as stated in p. 541 of the United Service Journal for December, 1831; and which, I think, will also be found to meet the objections of W. J. T. of Cambridge, page 260, in the number for October, 1832.

The plan consists in fixing an additional stem, made of iron, of sufficient strength, on the present stem of the vessel (already built), and securing the same by strong braces fixed securely on the bow, and hanging the rudder on the additional stem at the bow, precisely in the same way as the rudder at the stern is hung, as shown in the drawing.

The following results may be expected: 1st, The rudder at the stem is intended to act in unison with the rudder at the stern, by which means the same force would be exerted at each end of the vessel, and would unite in effect to bring the vessel round to the wind, and prevent her missing stays; 2d, When before the wind, or nearly so, the rudder on the stem might be allowed to swing, or be fixed, as thought necessary; 3d, When the tiller at the stem is put a little to leeward, and the rudder at the stern is made to act in unison with it, their combined influence would very much tend to keep the vessel to windward; 4th, The rudder at the stem would be an additional security in case of accident to the rudder at the stern, to which it is liable from going over a bar, and from other causes; 5th, The additional rudder at the stem appears particularly suitable for steam vessels, by which means the steersman at the bow would have it in his power to discover, and instantly avoid, every impediment in the ship's course; and would be particularly useful at night, and in foggy and boisterous weather, and in rivers crowded with vessels, both moving and stationary.

In the drawing, the keel is lengthened to the extremity of the foot of the rudder, to show an easy and safe mode of protecting it from accident, when the ship touches the ground at the stern. In building a new vessel, the keel may be carried out, in the first instance, of sufficient length to have the additional stem built in the frame of the vessel to receive the bow rudder; and the tiller

may be made in any form, and applied in any way, most convenient.

MECHANICS' WIVES.—Speaking of the middle ranks of life, a good writer observes:

"There we behold woman in all her glory: not a doll to carry silks and jewels, not a poppet to be flattered by profane adoration, reverenced to-day, discarded to-morrow; always jostled out of the place which nature and society would assign her, by sensuality or by contempt; admired, but not respected; desired, but not esteemed; ruling by passion, not affection; imparting her weakness, not her constancy, to the sex she would exalt; the source and mirror of vanity. We see her as a wife partaking the cares and cheering the anxiety of a husband, dividing his toils by her domestic diligence, spreading cheerfulness around her; for his sake sharing the decent refinements of the world, without being vain of them; placing all her joys and her happiness in the man she loves. As a mother, we find her the affectionate, the ardent instructress of the children whom she has tended from their infancy; training them up to thought and virtue, to piety and benevolence; addressing them as rational beings; and preparing them to become men and women in turn. Mechanics' daughters make the best wives in the world."

LESSONS ON HEALTH.—*Occupations which are unhealthy.*—Coffee roasters become asthmatic, and subject to head-ache and indigestion. Malsters (persons who prepare malt,) cannot live long, if they continue in the business. Snuff-making is unhealthy. Tea men suffer from the dust, especially of green teas. Brewers are apt to be unhealthy. Distillers are liable both to acute and chronic diseases. Chimney sweeps die early. House painters do not usually live to old age. Confectioners are by no means among the longest lived. Cooks are unhealthy; probably because they are apt to eat between meals, and eat up things to save them! Chemists and druggists are sickly and consumptive. Miners die young. Printers frequently complain of the stomach and head, but many are healthy. Engravers are sickly. Tailors, ropemakers, and shoemakers, usually suffer from their stooping postures. Milliners, dress makers, and straw-bonnet makers, are unhealthy and short lived. Watchmakers are sickly. Colliers, well sinkers, corn millers, paper makers, masons (these generally die by 40 or 50), iron filers, brass founders, copper smiths, tin plate makers, potters, plumbers, saddlers, and glass-blowers, are usually unhealthy. Butchers appear healthy, but they do not often live to old age.

Those which are healthy.—Farmers live long, though gardening is not so healthy, on account of stooping so much. Brickmakers, coopers, carpenters, fishmongers, wheelwrights, tanners, curriers, clockmakers, soap makers, tallow chandlers, dyers, grooms, hostlers, brush makers, men in oil mills, pressmen in printing offices, and bookbinders, are generally healthy.

ANIMAL WEATHER GLASS.—In Germany there will be found, in many country houses, an amusing application of zoological knowledge, for the purpose of prognosticating the weather. Two frogs are kept in a glass jar, about eighteen inches in height, and six in diameter, with the depth of three or four inches of water at the bottom, and a small ladder reaching to the top of the jar. On the approach of the dry weather, the frogs mount the ladder—but when wet weather is expected, they descend into the water. These animals are of a bright green.

IMITATION OF GOLD.—"A Chemist," of Washington City, publishes the following recipe for a preparation, which, applied to iron, will make it look like gold:

"Take of linseed oil, three ounces; tartar, two ounces; yolk of eggs, boiled hard and beaten, two ounces; aloes, half an ounce; saffron, five grains; turmerick, two grains. Boil all these ingredients in an earthen vessel, and with it wash the iron, and it will look like gold. If there be not linseed oil enough you may put in more."

THE PRESS.—[The following lines were written by the author of "Corn Law Rhymes" (a Journeyman Brazier of Sheffield, England,) on occasion of the procession in that town on the passing of the Reform Bill.]

God said, "Let there be light!"
Grim darkness felt his might,
And fled away;
Then startled seas, and mountains cold,
Shone forth all bright in blue and gold,
And cried—"'Tis day, 'tis day!"

"Hail, holy light!" exclaimed
The thunderous cloud, that flamed
O'er daisies white;
And lo! the rose in crimson dress'd,
Lean'd sweetly on the lily's breast,
And blushing, murmur'd, "Light!"

Then was the sky-lark born,—
Then rose the embattled corn,—
Then streams of praise
Flow'd o'er the sunny hills of noon;
And when night came, the pallid moon
Pour'd forth her pensive lays!

Lo, heaven's bright bow is glad!
Lo, trees and flowers, all clad
In glory, bloom!
And shall the mortal sons of God
Be senseless as the trodden clod,
And darker than the tomb?

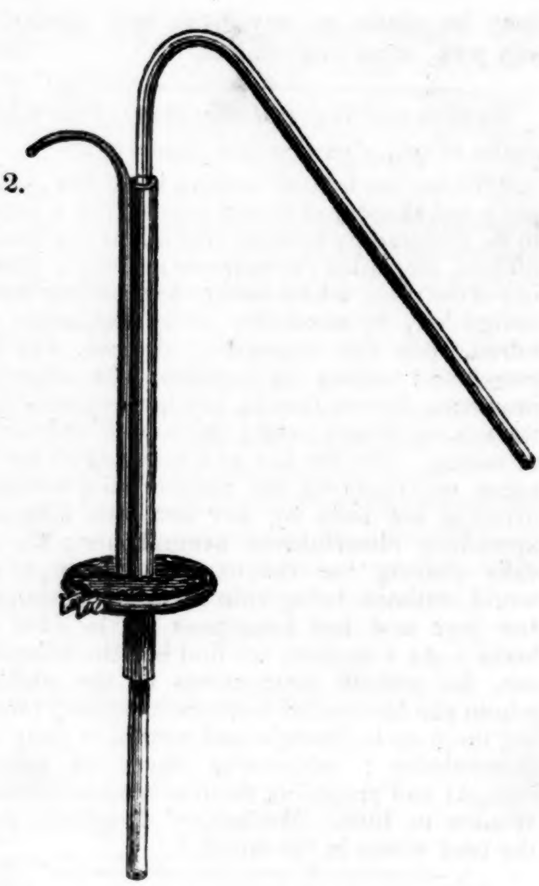
No! By the mind of man!
By the swart artizan!
By God, our sire!
Our souls have holy light within,
And every form of grief and sin
Shall see and feel its fire.

By earth, and hell, and heaven!
The shroud of souls is riven!
MIND—mind alone
Is light, and hope, and life, and power:
Earth's deepest night, from this bless'd hour,
The night of minds, is gone!

The second Ark we bring—
"The Press!" all nations sing:
What can they less?
Oh, pallid want! oh, labor stark!
Behold, we bring the second ark—
The Press!—the Press!—the Press!

Fig. 1.

Fig. 2.



Improved Syphons. By R. Hare, M. D., Professor of Chemistry in the University of Pennsylvania. [Communicated by the Author.]

Annexed are engravings of two syphons, which I have found useful in my laboratory. Of these, one represents the more complete method of execution; the other, that which can be more easily resorted to by chemists in general, who have no easy access to skilful workmen.

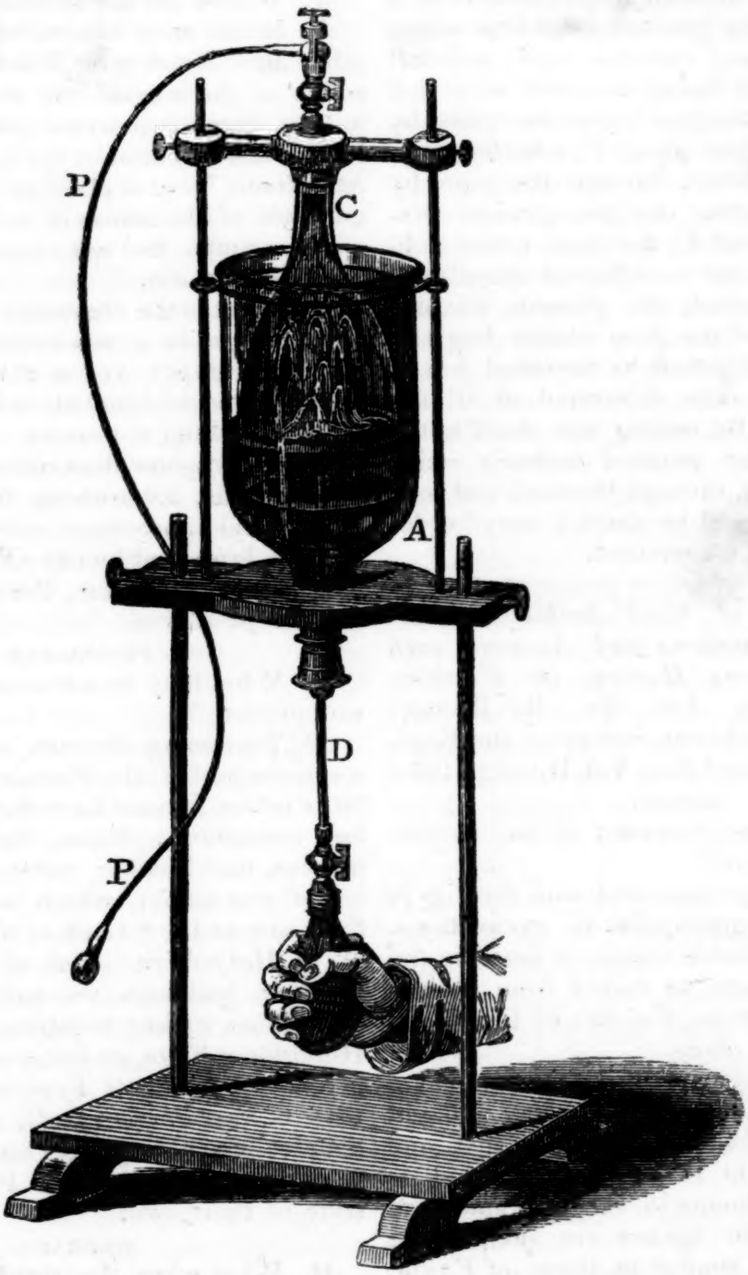
The construction last alluded to is represented by fig. 1. A cork is perforated in two places parallel to the axis. Through one of the perforations the longer leg of the syphon passes; into the other, one end of a small lead tube is inserted. In order to support this tube, it is wound about the syphon until it approaches the summit, where a portion, of about three or four inches in length, is left free, so that advantage may be taken of its flexibility to bend it into a situation convenient for applying the lips to the orifice. About the cork, the neck of a stout gum elastic bag is tied air tight. The joinings of the tubes with the cork must also be air tight. The lower half of the gum elastic bag is removed, as represented.

In order to put this syphon into operation, a bottle must be used, having a neck and mouth of such dimensions as to form an air tight juncture with the bag when pressed into it. This object being accomplished, the air must be inhaled from the bottle until the diminution of pressure causes the liquid to come over and fill the syphon. After this, on releasing the neck of the bottle, the current continues, as when established in any other way.

Fig. 2 represents the more complete construction. In this are two metal tubes, passing through perforations made for them in a brass disc, turned quite true. Through one of these tubes, which is by much the larger, the syphon passes, and is cemented air tight. The other answers the purpose of the leaden tube described in the preceding article. The brass disc is covered by a piece of gum elastic, which may be obtained by dividing a bag of proper dimensions. The covering thus procured is kept in its place by a brass band or clasp, made to embrace both it and the circumference of the plate, and to fasten by means of a screw.

Before applying the caoutchouc, it was softened by soaking it in ether, and a hole, obviously necessary, was made in the centre by a hollow punch.

There is no difference between operating with this syphon, and that described in the preceding article, excepting that the juncture of the syphon with the bottle is effected by pressing the orifice of the latter against the disc covered with gum elastic.



Apparatus contrived by Dr. Hare for separating Carbonic Oxide from Carbonic Acid, by means of Lime Water. **[Communicated by the Author.]**

Lime water being introduced in sufficient quantity into the inverted bell glass, another smaller bell glass, C, is supported within it, as represented in this figure. Both of the bells have perforated necks. The inverted bell is furnished with a brass cap, having a stuffing-box attached to it, through which the tube D, of copper, slides air-tight. About the lower end of this tube, the neck of the gum elastic bag is tied. The neck of the other bell is furnished with a cap and cock, surmounted by a gallows screw, by means of which a lead pipe, P P, with brass knob at the end suitably perforated, may be fastened to it, or removed at any moment. Suppose this pipe, by aid of another brass knob at the other extremity, to be attached to the perforated neck of a very tall bell glass filled with water upon a shelf of the pneumatic cistern, on opening a communication between the bells, the water will subside in the tall bell glass, over the cistern, and the air of the bell glass, C, being drawn into it, the lime water will rise into and occupy the whole of the space within the latter. As soon as this is effected, the cocks must be closed, and the tall bell glass replaced by a small one filled with water, and furnished with a gallows screw and cock. This bell being attached to the knob of the lead pipe, to which the tall bell had been fastened before, the apparatus is ready for use. I have employed it in the new process for obtaining carbonic oxide from oxalic

acid, by distillation with sulphuric acid in a glass retort. The gaseous product consists of equal volumes of carbonic oxide and carbonic acid, which being received in a bell glass, communicating as above described by a pipe with the bell glass C, may be transferred into the latter, through the pipe, by opening the cocks. As the gaseous mixture enters the bell C, the lime water subsides. As soon as a sufficient quantity of the gas has entered, the gaseous mixture may, by means of the gum elastic bag and the hand, be subjected to repeated jets of lime water, and thus depurated of all the carbonic acid. By raising the water in the outer bell, A, the purified carbonic oxide may be propelled, through the cock and lead pipe, into any vessel to which it may be desirable to have it transferred.

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By Robert Brindley, Architect, Surveyor, and Engineer. [Continued from Vol. II., page 195.]

INDIAN.

Q. What is the character of the ancient Indian architecture?

A. It is closely connected with the Egyptian, consisting principally in excavations. The most remarkable temple is found in the island of *Elephanta*, so called from an elephant of black stone, the size of life, being near the landing place.

Q. Of what description is this temple?

A. This temple is elevated, being wrought in a hill; it forms a square of 130 feet, and the interior height is 14½ feet; the roof is supported by columns in ranges; and upon the walls gigantic figures are sculptured; the columns are similar to those of Egypt, and the capitals flat, like cushions.

Q. What other temple is there?

A. One in the Island of Salsette. The excavation describes a square of 28 feet, approached by a long walk; at the end of which is the outer door-way, 20 feet high, opening into the vestibule, and passing from thence, by an inner door, into the temple. Figures are sculptured on each side of the door. The roof is supported by 20 columns 14 feet high, like those of Elephanta.

Q. Are there any other buildings?

A. Yes. The excavations of Ellora, at Canarah, and other places, are of similar character.

PERSIAN.

Q. What of Persian architecture?

A. The ancient ruins of Persia indicate many superior attainments in the art.

Q. Where are the most distinguished?

A. In the once celebrated city of Perseopilis, now *Estakar* or *Tehel Minar*, are the relics of the magnificent palace, which, for a long time, comprised 40 pillars or columns, denominated by the inhabitants "*Chehul Minar*," i. e. a place of 40 pillars. The adhesion of the stones in this fabric is effected by cramps, and not cement, many traces of which remain.

Q. What is the character of these ruins?

A. There is a resemblance in them to those of Egypt; yet a distinction will be found by the adornments sculptured in relief on the building, consonant with the luxurious and pompous disposition of the people. These ruins, astonishing the traveller by their grand appearance, are now the habitations of birds and beasts of prey. Several inscriptions in Arabic, Persian, and Greek, are still preserved.

PHŒNICIAN.

Q. What may be advanced on Phœnician architecture?

A. Possessing the arts of civilization, at a remote period, the Phœnicians had several large cities, famous for riches, manufactures, and commerce: Sidon, Tyre, Joppa, Damascus, and Baalbic, substantiate the prowess of this nation, which is supposed to be the same as the "Land of Canaan," spoken of in Holy Writ. But of the description of their buildings we have no criterion. Herodotus makes mention of a temple of Hercules at Tyre, as being very superb; and Strabo, speaking of Tyre and Dradus, two isles in the Persian Gulf, adds, "they had temples resembling the Phœnicians;" clearly demonstrating that the Phœnicians had a style of their own.

HEBRAIC.

Q. What were the dwellings of the Hebrews or Israelites?

A. From the roving disposition of these people, their dwellings were those of tents. The tent denominated the Tabernacle, and described in the Bible, was used for a length of time after the conquest of Palestine, A. C. 300.

Q. Did the Jews acquire any civilization in Egypt during their bondage?

A. Yes; and from what they had seen in Egypt, they, after their deliverance, betook themselves to building a temple.

Q. Under whose reign was the temple begun?

A. That of Solomon; the details of which are very much confined in Scripture. The summit of mount Moriah formed a plane of 36,310 square feet; the top was levelled, and a wall built of free-stone 400 cubits

high. The circumference of the mountain at the foot was 3000 cubits; upon this plane was built the temple, divided into two divisions, by a partition of cedar.

Q. What description may be gathered of this temple?

A. In the principal front was the *Ulam*, or grand portico. The windows of the temple were similar to those of Thebes: timbers of cedar, and roof flat, like the Egyptian. Round the temple was a wall; the space between which and the temple was occupied by the porch, divided into three stories. The principal edifice was preceded by two courts: 1st, for the people; 2d, called the Priest's court, was the temple, surrounded with apartments for the priests. Before the Ulam were two pillars of brass, the capitals of which resembled the *Lotus*, found in Egypt, but there were no bases. These were to decorate, as the obelisks before Egyptian temples. The exterior walls of the temple were stone, squared at right angles, ornamented with figures, &c. The roof was covered with plates of gold, and the interior was decorated in the richest manner with draperies.

Q. What character or order of this temple may be defined?

A. Of this temple it is difficult to form any definition. The Phœnician artists most likely were engaged. About 40 years before the dedication of the temple, a colony from the Ionian islands migrated and settled in Asia Minor; and although the arts did not flourish much in Greece for a long period after Solomon, is certain, (since Homer, who was contemporary with Jehosaphat, and whom some chronologists place down so low as Hezekiah, gives no account of columns of stone in all his writings) yet Solomon's pillars, with the chapter, &c. in construction, bear some analogy to those which were afterwards in vogue in the most flourishing period of Greece.

Q. What conclusive opinion may be drawn?

A. That the temple embraced a mixture of order, borrowed from its precursory Egyptian; in which the Ionian and Doric were introduced in their rudest shapes.

Q. Can Solomon's temple be considered as a model of architecture to the whole world?

A. Certainly not. Yet no doubt but imitations have been made from it by different nations, and handed down in various stages, till divided into the definite, yet elaborate Grecian and Roman orders.

CHINESE.

Q. What are the original models of Chinese architecture?

A. Tents and pavilions.

Q. What are the materials employed in building?

A. Different kinds of wood, with bricks and tiles burnt or dried in the sun.

Q. What is the prevailing style of Chinese architecture?

A. Mr. Elmes has observed "that it must be familiar to every one who has drunken from a China cup, or noticed the signs at grocers' shops." An observable point is the abundant use of pillars of wood to support their roofs, with marble or stone bases. When used externally, they support a viranda or outer roof, which being too low for a house, a second roof is constructed, with the peristyle much higher.

Q. What is the governing rule of Chinese architecture?

A. Prescriptive police regulations. Hence the palaces for 1st, 2d, and 3d order of the Imperial family—of a Mandarin or grandee of the empire—the public edifices of the capital, and also of provincial cities or towns, according to their different grades in the empire,—all yield in subserviency, producing the greatest monotony.

Q. For what are the palaces of China remarkable?

A. Their great extent, number of courts, galleries, &c.; in imitation of which is the pavilion at Brighton.

Q. What are the pagodas?

A. Lofty towers, being pile upon pile. An extraordinary one is at Nankin, covered outside with porcelain. A pagoda was erected under Sir W. Chamberlain, in Kew Gardens, in celebration of the proclamation of peace, in 1814.

Q. What are the most gigantic works of China?

A. The construction of a bridge, extending from one summit of a very high mountain to the other, consisting of one span; also, the celebrated wall dividing China from Tartary, being upwards of two thousand miles in length, and so broad that several horsemen can ride abreast of each other on the top. Forty-five thousand towers are said to be erected on the same.

GRECIAN.

Q. What kingdoms were successively founded in Greece?

A. Argos, established under Inacus, A. C. 1856; Athens, under Cecrops, A. C. 1556; and Thebes, Sparta, and others, A. C. 1493.

Q. Define the origin and progress of Grecian architecture, the prototype of which is to be sought in that of the Egyptian?

A. Cadmus, who flourished 1500 years before the Christian era, is said to have in-

troduced the arts and sciences into Greece, about 560 years after the building of the walls of Babylon.

Q. What city did Cadmus build?

A. Thebes, named after the celebrated one in Egypt, and in all probability built under similar arrangements and style of architecture.

Q. Did art shed its beams over these unimportant colonies?

A. Yes; and gradually diffused a taste throughout the colonies, the correctness, simplicity, and elegance, of which have been the models of passing ages.

Q. What might tend to mature the art?

A. The religion of the Greeks, dressed in splendid mythology, contributed abundant subjects for the painter, the sculptor, and the architect. The Lacedemonians embellished their chambers with the most exquisite models of loveliness and symmetry.

Q. What were the first materials used by the Greeks in their sacred buildings?

A. Timber, then brick: the art of making which they learned from the Egyptians: subsequently stone was employed, as in the temple of Apollo, on Mount Lucas, built by Amphyctyon, and ultimately marble.

Q. What methods of construction were introduced?

A. There were three: 1st, *Isodomon*, with courses of equal lengths and thicknesses; 2d, *Pseudisodomon*, admitting different heights, lengths, and thicknesses of the courses; 3d, *Emplecton*, the front stones being only wrought; the inner part filled up with rubble. The last was chiefly employed in rude work, as walls.

Q. Did the Greeks use *cement*?

A. No; the weight of the stone and the nicety with which it was worked precluded the necessity.

Q. What was a distinguishing feature in Grecian architecture?

A. Every ornament introduced was in concord with the peculiar order employed, and also with the character and object of the edifice. The external embellishments were bold, although simple, and never redundant.

Q. How were the pediments of the temples and the metopes of the frieze decorated?

A. With *bassi relievi*; and the angles of the walls with pilasters, such as the temples of Minerva and of Theseus, at Athens, and of Jupiter Panhellenieus at Egina.

Q. Of what figures were the temples?

A. Principally quadrilateral, differing only in size, order of architecture, number of columns, and disposition of porticos.

Q. What order most prevailed in Greece before the Macedonian conquest?

A. The Doric, which also was established in Italy and Sicily.

Q. What added splendor to the Grecian edifices?

A. A serene sky, and a splendid sun shedding his rays on the marble, which reflected the most beautiful golden tinge.

ETRUSCAN.

Q. What of the Etruscan architecture?

A. It stands nearly co-equal with that of Greece, the Etruscans being a colony of Grecians. It is also the parent of the Roman style, with which, at a very early period, it became closely identified with the history of this great people, one of the two orders super-added by the Romans (Tuscan) deriving its name therefrom.

Q. What are its distinguishing marks?

A. The invention of *Atriæ*, or court-yards, in front of houses, first introduced into Atria. This plan was simple, consisting of a parallelogram surrounded by a portico, and supported by rough columns.

Q. Was the arch known to the Etruscans?

A. Yes; and their columns differed from other nations. Vitruvius has honored them with forming a new order.

Q. What surprising specimen of the art have the Etruscans afforded?

A. The tomb of Porsenna, king of Etruria, built by him in the city of Clusium.

ROMAN. A. D. 350.

Q. How did the Romans advance in their buildings?

A. Generally improving on the ruder models which they had adopted from their neighbors (the Tuscans), by their connection with Greece itself.

Q. What is described of the earliest Roman edifices?

A. That they were without columns; the greater part of their temples circular, and covered with cupolas, as those of Romulus, Cybele, Vesta, Mars, and the Sybils.

Q. What ideas did the Romans form of pediments, columns, and cornices?

A. In opposition to the Greeks, who deemed them as principal and necessary component parts, the Romans introduced them as merely extraneous ornaments.

Q. What was the result of this mistaken idea?

A. A source of great inconsistency. Vespasian's Temple of Peace exhibits a vault of ground arches, sustained at the springing of each groin by a single Corinthian column. The Colosseum and Theatre of Marcellus have sundry stories of arcades, whilst the

intermediate piers are adorned with engaged columns.

Q. How did the Romans differ from the Greeks in construction?

A. The principal parts of their temples, including the body and columns, were formed of small bricks or stone, united by strong cement, and cased on every side with marble, which were lavishly adorned. The pilasters and pannels of the second story of the interior of the Pantheon present a specimen of this kind of work, designated by the Italians "*umbratile.*"

Q. In what stupendous undertakings did the Romans excel?

A. The throwing over the immense area of the Pantheon, the pensile vault, and the construction of immense aqueducts, inventions utterly unknown to the Greeks. Triumphal arches, forums, and columns, constitute leading features with the Romans.

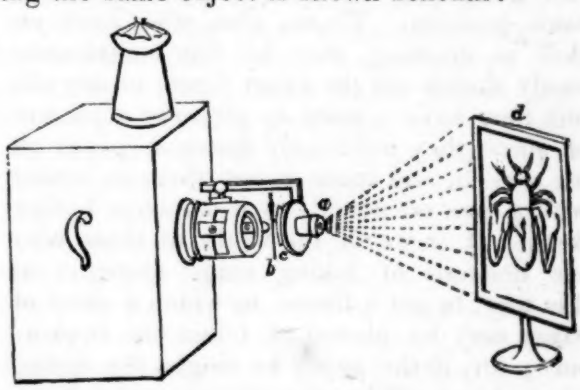
Q. What is the comparison between the rival countries of Greece and Rome?

A. The prominent features of the pure Grecian style are invention, elegance, and strict beauty; yet not destitute of richness. Those of the Romans are a display of splendor, vastness of extent, carelessness of expense, and redundancy of ornaments.

Consumption of Staple Articles in England.—The following is an accurate estimate of the home consumption of England in the great staple articles of commerce and manufactures. Of wheat, 15,000,000 quarters, or 120,000,000 bushels, are annually consumed in Great Britain—this is about a quarter of wheat to each individual; of malt, 25,000,000 bushels are annually used in breweries and distilleries in the United Kingdom, and there are 46,000 acres under cultivation with hops; of the quantity of potatoes and other vegetables consumed we have no accounts; of meat, about 1,250,000 head of cattle, sheep, and pigs, are sold during the year in Smithfield market alone, which is probably about a tenth of the consumption of the whole kingdom; the quantity of tea consumed in the United Kingdom is about 30,000,000 pounds annually; of sugar nearly 4,000,000 cwts., or about 500,000,000 pounds every year, which is a consumption of 20 pounds for every individual, reckoning the population at 25,000,000; and of coffee about 20,000,000 pounds are annually consumed; of soap 114,000,000 pounds are consumed; and of candles about 117,000,000 pounds; of sea-borne coals alone there are about 3,000,000 chaldrons consumed in England and Wales, and it is estimated that, adding the coals of the midland counties, each person of the population consumes a chaldron throughout the kingdom; of clothing we annually manufacture about 200,000,000 pounds of cotton wool, which produces 1,200,000,000 yards of calico, and various other cotton fabrics, and of these we export about a third, so that 800,000,000 yards remain for home consumption, being about 32 yards annually for each person; the woollen manufacture consumes about 30,000,000 pounds of wool; of hides and skins about 50,000,000 are annually tanned and dressed; of paper about 50,000,000 pounds are annually manufactured, which is about 2,000,000 reams of 500 sheets to the ream.—[Farmer's Magazine.]

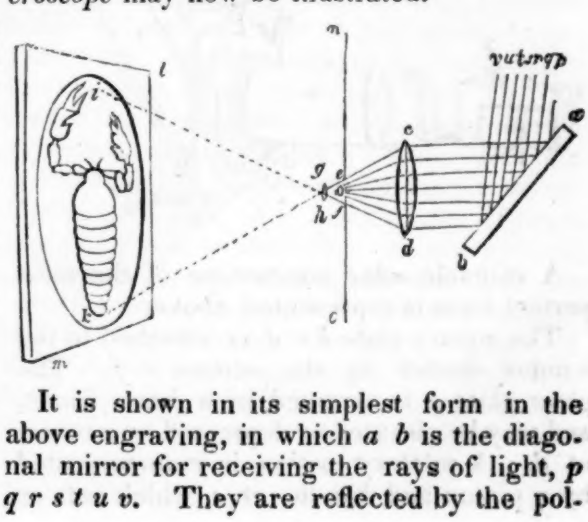
On the Microscope—Method of Constructing, &c. Concluded from page 60. [From Partington's British Cyclopædia.]

Another still more simple mode of effecting the same object is shown beneath:



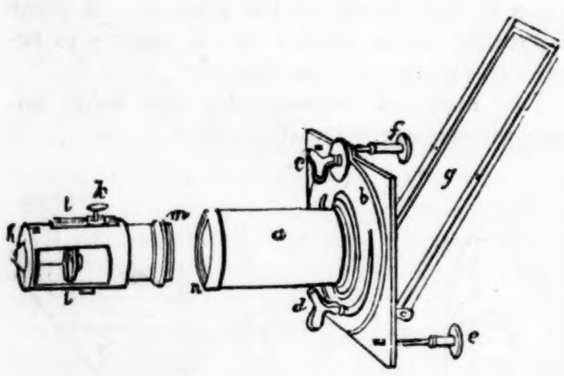
The lantern is provided with a sliding tube for the introduction of the objects to be magnified. The moveable lenses are shown at *a*. Other objects differing in their character may be placed in the forceps, *b*, attached to the sliding frame by the plate *c*. A plate of ground glass, shown at *d*, serves to receive the figure of the object.

The mode of constructing the *solar microscope* may now be illustrated.



It is shown in its simplest form in the above engraving, in which *a b* is the diagonal mirror for receiving the rays of light, *p q r s t u v*. They are reflected by the pol-

ished surface, and thrown on the lens *c d*. Within the focus, at *e f* is placed any transparent object to be magnified, and the image thus illuminated passes through the lens *g h*. The size of the magnified figure, *i k*, will depend on the distance the instrument is placed from the wall *l m*. The room should be darkened, which is usually effected by employing a large shutter at *n o*. Mr. Baker, speaking of this instrument, says, "that it has conveniences attending it which no other microscope can have: for the weakest eyes may use it without the least straining or fatigue. Numbers of people together may view any object at the same time, and by pointing to the particular parts thereof, and discoursing on what lies before them, may be able better to understand one another, and more likely to find out the truth, than in other microscopes, where they must peep one after another, and perhaps see the object neither in the same light nor in the same position. Those, also, who have no skill in drawing, may by this contrivance easily sketch out the exact figure of any object they have a mind to preserve a picture of, since they need only fasten a paper on the screen, and trace it out thereon, either with a pen or pencil, as it appears before them. It is worth the while of those who are desirous of taking many draughts in this way, to get a frame, in which a sheet of paper may be placed or taken out at pleasure; for, if the paper be single, the image of an object will be seen almost as plainly on the back as on the fore side; and, by standing behind the screen, the shade of the hand will not obstruct the light in drawing, as it must in some degree when one stands before it."



A valuable solar microscope of the most perfect form is represented above.

The square plate *b c d* is attached to the window-shutter by the screws *e f*. The glass plate *g* is mounted in a brass frame, and may be elevated or depressed by a screw at *d*. A rotatory motion is communicated by a pinion and handle at *c*, which acts on a large wheel concealed by the square plate. The first lens is placed in the tube *a*, immediately adjoining the mirror. Another tube *m* is attached by a screw at *n*, and contains two small lenses, and the rack-work, *k l*, for adjusting the focus of the instrument. The objects are introduced at *i*; those best fitted for exhibition are the wings of insects, and the cuttings of wood. When glasses of high power are employed at *h*, they are now constructed on the achromatic principle.

We may now proceed to furnish our readers with some necessary particulars respecting the method of using microscopes. On this, Mr. Adams, in his ***Essay on the Microscope***, has been very copious; with a view, as he informs us, to remove the common complaint made by Mr. Baker, "that many of those who purchase microscopes are so little acquainted with their general and extensive usefulness, and so much at a loss for objects to examine by them, that after diverting their friends some few times with what they find in the sliders which generally accompany the instrument, or perhaps with two or three common objects, the microscope is laid aside as of little further value; whereas, no instrument has yet appeared in the world capable of affording so constant, various, and satisfactory an entertainment to the mind."

In using the microscope there are three things necessary to be considered. 1. The preparation and adjustment of the instrument itself. 2. The proper quantity of light, and the best method of adapting it to the object. 3. The method of preparing the objects, so that their texture may be properly understood.

With regard to the microscope itself, the first thing necessary to be examined is, whether the glasses be clean or not: if they are not so, they must be wiped with a piece of soft leather, taking care not to soil them afterwards with the fingers; and, in replacing them, care must be taken not to place them in an oblique direction. We must likewise be careful not to let the breath fall upon the glasses, nor to hold that part of the body of the instrument where the glasses are placed with a warm hand; because the moisture thus expelled by the heat from the metal will condense upon the glass, and prevent the object from being distinctly seen. The object should be brought as near the centre of the field of view as possible, for there only will it be exhibited in the greatest perfection. The eye should be moved up and down from the eye-glass of a compound microscope, till the situation is found where

the largest field and most distinct view of the object are to be had, but every person ought to adjust the microscope to his own eye, and not depend upon the situation it was placed in by another. A small magnifying power should always be begun with, by which means the observer will best obtain an exact idea of the situation and connection of the whole, and will of consequence be less liable to form any erroneous opinion, when the parts are viewed separately by a lens of greater power. Objects should also be examined first in their most natural position; for, if this be not attended to, we shall be apt to form very erroneous ideas of the structure of the whole, as well as of the connection and use of the parts. A living animal ought to be as little hurt or discomposed as possible. From viewing an object properly we may acquire a knowledge of its nature; but this cannot be done without an extensive knowledge of the subject, much patience and many experiments; as in a great number of cases the images will resemble each other, though derived from very different substances. Mr. Baker, therefore, advises us not to form an opinion too suddenly after viewing a microscopical object; nor to draw our inferences till after repeated experiment and examinations of the objects in many different lights and positions; to pass no judgment upon things extended by force, or contracted by dryness, or in any manner out of a natural state, without making suitable allowances. The true color of objects cannot be properly determined by very great magnifiers; for, as the pores and interstices of an object are enlarged according to the magnifying power of the glasses made use of, the component particles of its substance will appear separated many thousand times further asunder than they do to the naked eye: hence the reflection of the light from these particles will be very different, and exhibit different colors. It is likewise somewhat difficult to observe opaque objects; and as the apertures of the larger magnifiers are but small, they are not proper for the purpose. If an object be so very opaque that no light will pass through it, as much as possible must be thrown upon the upper surface of it. Some consideration is likewise necessary in forming a judgment of the motion of living creatures, or even of fluids, when seen through the microscope; for, as the moving body, and the space wherein it moves, are magnified, the motion will also be increased.

On the management of the light depends, in a great measure, the distinctness of the vision; and as, in order to have this in the greatest perfection, we must adapt the quantity of light to the nature of the object, and the focus of the magnifier, it is therefore necessary to view it in various degrees of light. In some objects it is difficult to distinguish between a prominence and a depression, a shadow and a black stain; or between a reflection of light and whiteness, which is particularly observable in the eye of the libella, and other flies, all of these appearing very different in one position from what they do in another. The brightness of an object likewise depends on the quantity of light, the distinctness of vision, and on regulating the quantity to the object; for one will be in a manner lost in a quantity of light scarcely sufficient to render another visible.

There are various ways in which a strong light may be thrown upon objects, as by means of the sun and a convex lens. For this purpose the microscope is to be placed about three feet from a southern window; then take a deep convex lens, mounted on a semi-circle and stand, so that its position may easily be varied; place this lens between the object and the window, so that it may collect a considerable number of rays, and refract them on the object or the mirror of the microscope. If the light thus collected from the sun be too powerful, it may be lessened by placing a piece of oiled paper, or a piece of glass slightly ground, between the object and lens. Thus a proper degree of light may be obtained, and diffused equally over the surface of an object, a circumstance which ought to be particularly attended to; for if the light be thrown irregularly upon it, no distinct view can be obtained.

On account of the sun's motion, and the variable state of the atmosphere, solar observations are rendered both tedious and inconvenient, so that it may be advisable for the observer to be furnished with a large tin lantern, formed something like the common magic lantern, capable of containing an argand lamp. There ought to be an aperture in the front of the lantern, which may be moved up and down, and be capable of holding a lens, by which means a pleasant and uniform as well as strong light may easily be obtained. The lamp should likewise move on a rod, so that it may be easily raised or depressed. A weak light is best fitted for viewing many transparent objects, among which we may reckon the prepared eyes of flies, as well as the animalculæ in fluids. The quantity of light from a lamp or candle may be lessened by removing the microscope to a greater distance from them, or by diminishing the strength of the light

which falls upon the objects. This may very conveniently be done by pieces of black paper with circular apertures of different sizes, and placing a larger or smaller one upon the reflecting mirror, as occasion may require. The light of a lamp or candle is generally better for viewing microscopic objects than day-light, it being more easy to modify the former than the latter, and to throw it upon the object with different degrees of intensity.

With regard to the preparation of objects, Swammerdam has, in that respect, excelled almost all other investigators who either preceded or have succeeded him. He was so assiduous and indefatigable, that neither difficulty nor disappointment could make the least impression on him; and he never abandoned the pursuit of any object until he had obtained a satisfactory acquaintance with it. Unfortunately, however, the methods he made use of in preparing his objects for the microscope are now entirely unknown.

For dissecting *small insects*, Swammerdam had a brass table, to which were attached two brass arms, moveable at pleasure. The upper part of each of these vertical arms was constructed in such a manner as to have a slow vertical motion, by which means the operator could readily alter their height. One of these arms was to hold the minute objects, and the other to apply the microscope.

The lenses of Swammerdam's microscopes were of various sizes as well as foci. His observations were always begun with the smallest magnifiers, from which he proceeded by progressive steps to the greatest.

The minute scales or feathers which cover the wings of moths or butterflies afford very beautiful objects for the microscope. Those from one part of the wing frequently differ in shape from such as are taken from other parts; and near the thorax, shoulder, and on the fringes of the wings, we generally meet with hair instead of scales. The whole may be brushed off the wing upon a piece of paper, by means of a camel's hair pencil; after which the hairs can be separated, with the assistance of a common magnifying glass.

Great difficulty is experienced in dissecting properly the proboscis of insects, such as that of the gnat, and the experiment must be repeated a great number of times before the structure and situation of the parts can be thoroughly investigated, as the observer will frequently discover in one what he could not in another. The *collector of the bee*, which forms an exceedingly curious object, ought to be carefully washed in spirit of turpentine, by which means it will be freed from the unctuous matter adhering to it; when dry, it is again to be washed with a camel's hair pencil, to disengage and bring forward the small hairs which form part of its microscopic beauty. The best method of preparing the stings of insects, which are in danger of being broken, from their hardness, is to soak the case and the rest of the apparatus for some time in spirit of wine or turpentine; then lay them on a piece of paper, and with a blunt knife draw out the sting, holding the sheath with the nail of the finger, or any other blunt instrument; but great care is necessary to preserve the feelers, which, when cleaned, add much to the beauty of the object. The *beard* of the lepas antifera is to be soaked in clean soft water, frequently brushing it while wet with a camel's hair penctl; after it is dried, the brushing must be repeated with a dry pencil, to disengage and separate the hairs, which are apt to adhere together.

The eyes of insects in general form very beautiful and curious objects. Those of the libellula and other flies, as well as of the lobster, &c. must be cleaned from the blood, &c. after which they should be soaked in water for some days: one or two skins are then to be separated from the eye, which would be otherwise too opaque and confused; but some care is requisite in this operation, for, if the skin be rendered too thin, it is impossible to form a proper idea of the organization of the part. In some substances, however, the organization is such that by altering the texture of the part, we destroy the objects which we wish to observe. Of this sort are the nerves, tendons, and muscular fibres, many of which are viewed to most advantage when floating in some transparent fluid. Thus very few of the muscular fibres can be discovered when we attempt to view them in the open air, though great numbers may be seen if they be placed in water or oil. By viewing the thread of a ligament in this manner we find it composed of a vast number of smooth round threads lying close together. Elastic objects should be pulled or stretched out while they are under the microscope, that the texture and nature of those parts, the figure of which is altered by being thus extended, may be more fully discovered.

To examine bones by the microscope, they should first be viewed as opaque objects; but afterwards, by procuring thin slices of them, they may be viewed as transparent. The sections should be cut in all directions, and well washed and cleaned; and, in some cases, maceration will be useful, or the

bones may be heated to a high temperature, in a clear fire, which will render the bony cells more conspicuous.

On the Improved Art of Boring for Water, as practised in the United States: and as the Foundation of a Water Company in New-York. By John L. Sullivan. [From the American Railroad Journal and Advocate of Internal Improvements.]

The practice of boring for water appears to have been first undertaken from the rational probability of its success; but it was found necessary very much to improve the instruments of the art, on account of the nature of the rock and soil. And, for economy of labor, to devise a mode of applying the power of the steam engine to a machine which raises the chisel and allows its blow by sudden release and fall.

The alluvial soil, in which the operation is often to be carried on more deep than wells could be made, required, to reach the rock, the invention of an iron tube, having the quality of great stiffness, without any considerable projection at the joints, both in order to be forced down by powerful leverage, and to be clear within, for the operations to be carried on through it. Being undermined at the same time that pressure is exerted, it, by successive *lengths*, reaches the rock to be bored into, *through it.* Should there not, as often occurs, have been found abundance of water at the surface thereof, implements to overcome any obstacle in the way have also been contrived.

The tube being entered a little into the rock, and pressed down, makes therewith a tight joint; and thus a perforation to the depth of *seven* hundred feet has in several instances been made. There are, indeed, accidents to which the operation is liable, but there are, also, implements to meet such exigencies; and experience has now rendered their management easy. The bore is generally first two and a half inches diameter; and if more water is required than it affords, or permits, it is enlarged to seven inches, by an instrument called the *reamer.*

When the work commences in a rock above ground, it is usual to excavate a small well, as the water often rises to the surface, or nearly so; or the bore is enlarged for the reception of the pump.

To bring up large quantities from a small bore, hydraulic principles have been superadded; which induce a more lively flow of water to the boring, and up into the pumps. The former, by abstracting the column and making a vacancy much below the height to which the water ordinarily rises; the other by placing the pumps externally on the sides of the bore, lower than the height to which the water rises. Thus availing of the natural difference between the head and the position of the pumps; that thus, filling quicker, they may be larger, and deliver more.

To be successful, this art seems only to require suitable instruments and requisite skill; and there have now been so many instances, that it begins to become a rational inquiry, whether there may not be, in the *geology* of our country, good cause always to expect success; and, instead of looking to distant ponds and streams for a supply of pure water, whether there may not be a provision by Nature, even for cities densely peopled, on the very spot they occupy?

The researches of geology seem to have established the most material facts in this inquiry, that the *primitive* rocks are always stratified. It appears, that, while the earth was yet without form, and void of life, the crystallization which constitutes the rocks was going on, and forming them in strata; of which, the cause can be but conjecture. It is possible that the process extricated the substance that makes the division between them, till its quantity was sufficient to deposit; and, being settled, the crystallization recommenced, thus forming successive layers. But that, besides the strata of its own kind, general layers of different kinds should have successively formed, is not less true than curious. In one mass, they might not have been so easily raised into mountains. Thus the *primitive* rocks are, it is believed, invariably found in the order or succession, upwards, of granite, granular limestone with quartz, gneiss, mica slate, soapstone, sienite, succeeded by the *transition* rocks, metalliferous limestone, argillaceous and siliceous slate, graywacke slate, and rubblestone; which are again succeeded by the secondary rocks, red sandstone, breccia, compact limestone, gypsum, and rocksalt; and over these the diluvial masses, or aggregations of rocks and earth; and among them the recent alluvial deposits.

Thus the granite of the highest mountains must, in its formation, have been level and low; but, when the formation of the dry land took place, was uphove by some physical cause, which the Creator had prepared.

On the Alps, in the vicinity of Mont Blanc, stupendous masses of granite stand up thousands of feet, as if protruded through strata of more recent formation, which slope down from them.

It appears that much the same operations, on the grandest scale, have prepared the continents for the habitations of man. The same *fiat* which caused dry land to appear, created the vallies, and the plains, the streamlets, and the rivers, and set bounds to the sea.

On the continent of North America, there are, obviously, three distinct systems of mountains. The central line of the Appalachian, being the Allegany mountains, is granite. And the eastern border of the base of the system may be described as appearing at *the falls of all the rivers'* nearest tide, discharging into the Atlantic south of the Hudson. In Darby's geographical view of the United States, page 81, it is said, "this inflected line, from New-York to the Mississippi, is marked, at distant intervals, by falls, or rapids, in the bed of the streams."

The Allegany mountains, being two thousand four hundred and seventy-three feet high, attract and condense the vapors and clouds, and is well known to be a more rainy region than the plains below, giving rise to numerous rivers.

It is reasonable to think, that when the granite strata rose from their original position, that cavities were formed by their disruption, and that whatever spaces occur, must be filled with water, and be the passage for it thence among the strata to the ocean; and if so, this water may be *intercepted*, in part, by perforating the strata. This might have been reasonably expected, and this expectation has been verified by trials.

The nearest boring to the Alleganies is at the Public Armory, near Harper's Ferry, on the Potomac. The next at Baltimore; again near the Schuylkill; again at Princeton; then at New-Brunswick; Somerville; Amboy; Newark; and Jersey City.

On the island of New-York there were stronger reasons for expecting to find water in the rock than elsewhere, because here commences the *third system of mountain formation*, dividing the waters of the *Hudson and Lake Champlain* from those of the bays of New-England. It commences here and extends northward, forming the mountains of Berkshire and Vermont. It is a range of primitive rock, the strata of which rise from the west and probably decline towards the east from the centre of New-England.

We have the authority of Professor Eaton, a teacher of Geology, to say that the strata of primitive rock, after spreading down from the west as far as the Hud-

son, begins to rise, and come to the surface in the Berkshire mountains. That they do thus actually slope upwards from the west is known by the excavations made in this island.

The city thus being at the point where the range commences its rise northward, at the same time the strata dip west, the waters therein *cannot* flow *east*, and must, of course, flow *south*. And that the spaces are full of pure water, is not only ascertained by its outpouring at the head of the streams of the Highlands in a thousand places, but by its actual abstraction here, in a number of instances, and by the *spontaneous outpourings* of it also *here* on the spot, in the very centre of the city.

The natural indications of water here were strong before any experiment was made. The rock springs of the 1st Ward were known before the Revolution; and the central valley, before it was occupied by streets, was the seat of large and deep collections of spring water; and one of these was, in 1798, deemed by the Common Council sufficient for the whole city; and it was a question whether it should not be *preserved for this purpose*. But it was filled up. Nevertheless, the springs which fed it are not lost: they continue to flow, and are, in fact, *recovered* by the effect of the deep tube above described. The two or three millions of gallons a day, which then flowed here, are regained and protected by a mass of earth from fifty to a hundred feet deep.

The proof of this fact is in the success of *three* tubes. Two of them in West Grand street, the other in Lawrence, near Canal, at Cram's distillery; and this one continually overflows on being reduced one or two joints.

There is also proof of the like issues of pure water on the east side, north of Chatham square, by the success of all the *tubes* that have been set down to the surface of the rock near the East river.

But on the west side the water is not obtained without penetrating the rock about one hundred feet, being on the top of the slope thereof, but this operation has in every instance been successful.

The general reason for expecting success in this operation being thus explained, the inquiry becomes perhaps the more interesting, how often the theory has been confirmed by practice? The instances have not been many, but are rather convincing. The least likely to succeed was that of the botanic garden, because begun on the bare apex of an elevated rock, about the highest ground in the island. It penetrates the rock 112 feet, and the water stands 94 feet deep, constantly renewed.

The next proof is one mile more south, at the great well of the Fire Engine Reservoir, 113 feet deep, of which 96 are in the rock, and considerable water is obtained.

West of this, near the Hudson, are those about one hundred feet deep, which supply the city with rock water, by means of drays; also, that at a distillery on Perry street, which gives 22 to 26,000 gallons a day.

More southerly, and on the highest part of Broadway, near Bleecker street, is that belonging to the Manhattan Company, lately the subject of consideration by the Board of Commissioners.

It will be recollected that this Company was instituted to bring in the Bronx water, which, at the time their charter was granted, was estimated to cost about 200,000 dollars; but, by more complete surveys, it was found very likely to absorb their whole capital of two millions, so as to defeat the purpose of employing the *surplus* of 1,800,000 as banking capital. The Company had employed double the amount of the original estimate in supplying the city with the best water they could command, when the progress of the art of boring for water came to the knowledge of the directors.

After making a well 42 feet deep, down to the surface of the rock, they penetrated it 400 feet, in the course of which operation good water was found between *all the lower strata*, and not less than *eight times*.

They were so well satisfied with the result, as to have it reamed to the diameter of 7 inches: and, by applying only the power of a *six horse* engine, raise about 130,000 gallons of water a day. And the Board of Commissioners pronounce it good and wholesome; it is in fact soft, and clear as crystal.

They also calculate that 42 such borings only would supply the city with six millions of gallons a day. This one cost ten thousand dollars.

The Company may possibly have expected to raise, at once, as much as would supply the pipes already laid down, by their agent, stated at nearly 700,000 gallons a day; if so, it was rather a too great demand on one boring, though this one is, in the improved mode of management, probably capable of producing considerably more than it as yet has done.

But from some other cause, probably the preference which the stockholders give to *banking* with their capital, their water-works are offered for sale to the city; and might well have been an object of purchase to any party competent to their perfection, as no doubt all the houses along an extensive range of pipes would take the water, were it all as good as that thus derived from the rock.

It has thus been shown why the *general formation of the country* is favorable to the system of deriving water from the rock, and why New-York, specially favored, has only to penetrate a little deeper than usual to find pure water in great abundance, at a moderate expense, and, when thus obtained, incomparably finer than that of the Schuylhill at Philadelphia, and free from all unfavorable influences of climate or locality: for, however dense the population of the city may be, the rock water is defended by the depth and nature of its channels.

An apology to your readers would be offered for the length of this article, but that the subject is now becoming an interesting one to most of our sea-port cities. At New-Orleans a company is incorporated, having a large capital, and a banking privilege. The Mississippi is perhaps the only river in our country that, like the Nile, comes at midsummer cool from distant mountains of ice.

But no stream can be other than a drain of the district it waters; and it is well known that impurities combine chemically with water.

The recent survey and report for an aqueduct route from the Croton, though at an expense very disproportionate to the present city, may be preferred by the community. But it is possible that the certainty and readiness, the inexhaustible nature of the sources which come hither in the natural aqueducts of the rock, have not yet been duly appreciated by the public. They certainly have not been by the commissioners; and it remains yet for public opinion to decide the interesting question, how the city of New-York shall be supplied with pure and wholesome water.

To leave behind so productive a source of supply as the rock affords, is like leaving a *fortress in the rear*.

This resource will, at all events, be the object of a company of capitalists. It has been solicited of the Common Council that leave be given to deliver it by aqueduct pipes. It is stated in the Water Committee's recent report, that the city actually pays 273,750 dollars for the water distributed by drays; and the shipping 50,000 dollars. They compute the number of

buildings for which water would be required at 35,000. They state that in the city of London there are eight water companies. It is not stated why the *Corporation* did not supply that city. The explanation would have been that, where capital is to be applied, those do it most economically who have the most interest in making it effectual. One of them is stated to have risen greatly in value.

New-York, January 11, 1834.

Undulating Railroads. By A. Canfield. To the Editor of the Mechanics' Magazine and Register of Inventions and Improvements.

Sir,—Having heard several of our most distinguished civil engineers express a disbelief in the theory of the undulating railroad as laid down by the ingenious discoverer of its advantages, (though they admit that they had not carefully examined the matter,) I am induced to offer some remarks on the subject.

What I propose to show is, that a car must and will run over an undulating road, with a moving power *less* than would be required to move it on a level road. Though, to my mind, this is abundantly proved by Mr. Badnall, I shall take a different course to arrive at the same conclusion.

Let us first suppose a car placed on a level road, and a locomotive power applied which is just sufficient to overcome all friction. Now, the smallest additional force will put the car in motion; and the velocity will be exactly proportional to the said additional force. We will suppose it to be so small as to produce the least conceivable velocity. Now, we will suppose the same car to be placed at one of the apexes of an undulating road. We will suppose the undulations to be segments of circles. Now, if a power is applied barely sufficient to overcome all the friction, it is certain that the car will run down and ascend on the opposite portion of the circle to the same height as that from which it started; and the principle of this movement is in no respect different from that of a pendulum vibrating in the same circle. If we then suppose the undulation or segment of the circle to be the same as that described by a "second pendulum," it will follow as an inevitable conclusion, that the car must pass from one apex to the other in *one second of time.* Here then is a certain distance on the undulating road passed over in a certain limited time, whereas, on the horizontal road, with the same moving power, the time occupied may be as great as can be imagined. You will observe, (and it is important,) that this result is obtained, notwithstanding that the friction is supposed to be constantly the same on both roads, and, of course, the amount of friction *greater* on the undulating, (as it is longer,) than on the level road.

But the most important fact is the one stated by the inventor, viz. that the pressure from a car is less on an inclined than on a horizontal road. This is certainly true, since a part of the gravitating force or weight of the car must be exerted, or expended, in accelerating the motion in descending; and the same portion of the gravitating force must be sustained, or overcome, by the moving power in ascending, and the amount of pressure from which the rails are thus relieved is the same, whether the moving power be an impulse or a constantly acting power. This leads to a very surprizing conclusion, viz. that since the pressure upon the rails diminishes in proportion to their steepness, it follows that the steeper the undulations the *less* moving power will be required; and this must be the fact, until the pressure upon the road is so much reduced that the locomotive power will cause the wheels to slip on the rails. I here, of course, suppose that there shall be no loss of momentum in consequence of the change of direction of the moving body.

Another proposition that bears on the case is, that the pressure of the car on the rails is diminished in the same proportion as the velocity is increased, and from this cause the friction is lessened in the same proportion. To prove this in a few words, let us suppose such a velocity to be given to a car as will cause it to move parallel to the surface of the earth, without touching the rails; now, but a moment's thought is necessary to show, that if this velocity be diminished, the pressure on the rails will begin, and will increase in exact proportion to the diminution of velocity, and the friction arising from this pressure will increase in the same proportion.

If, then, it is proved that the friction or resistance to motion is less, it cannot be denied that the same moving power will produce a greater velocity on an undulating than on a level road; at the same time, I hold it to be proven by my first proposition, that if the friction were the *same* on both roads, that the undulating road still has a decided advantage.

I would not at this time go so far as to make an undulating road over a level route, nor do I suppose that very long or very steep planes can be used; yet I see no reason to doubt that this will be found to be one of the most important improvements that have been made in railroads.

I am, Sir, respectfully, your obedient servant,

A. Canfield.

Paterson, N. J., Jan. 2, 1834.

Mr. Symington, the Original Inventor of Steam Vessels. By Robert Bowie. [From the United Service Journal, for September.]

Mr. Editor,—The article concerning steam navigation contained in your last number has afforded me no little pleasure, as it assists materially in establishing the justice of the claims I am now engaged in advocating on behalf of a highly-talented and deeply-regretted relative, the late William Symington.

To alter the opinion of your intelligent and impartial contributor, with regard to Mr. Hull, will, I am persuaded, require but examination of the mode proposed for constructing the machinery and applying the power of steam,—a mode which has been pronounced, by skilful and practical mechanicians, visionary and impracticable.

As to the Marquis de Jouffroy, his experiments are so completely unknown, that, for any benefit derived from them, they might as well never have existed. And it is the general belief respecting them that they were incomplete, and unfit for bringing the undertaking to a favorable conclusion. That such a belief was not unfounded may be inferred from the imperfect state of the steam engine of that day, and the failure of the subsequent and imitative attempts said to have been made by De Blan and Fulton; the latter of whom, Fulton, was only able to accomplish his object after having had an opportunity of minutely examining Mr. Symington's boat, receiving explicit answers to printed questions, and jotting down his observations as he was carried along the canal on board of the vessel.

Contending, therefore, that the mere idea of the practicability of steam navigation, without

the ability for its realization, possesses but little, if any value, I feel myself warranted in claiming for him who first successfully applies the power of the steam engine for the propulsion of vessels, the honor and credit of the invention; and I feel myself warranted in my proceeding, by the firm conviction that he was indebted to no one for the idea, it having occurred to himself long before he became aware of its ever having been entertained by others.

In 1784 he imagined it possible for steam power to be rendered applicable to terro-locomotion; and in 1786, he exhibited in Edinburgh a working model of a steam carriage. He then bethought himself that the same power might be rendered available for propelling vessels. His first boat appeared on Dalswinton Lake, in 1788, and his second on the Forth and Clyde canal the succeeding year: both of which as completely illustrated the practicability of steam navigation as any ever since exhibited.

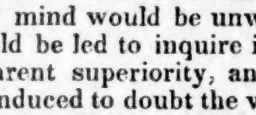
In your Magazine it is stated that the first boat appeared in 1789, on the Forth and Clyde canal, and resembled Hull's, in being a tug. This is an error, as neither the one of 1788, nor that of 1789, at all resembled the boat proposed by Hull; nor were they intended to be used solely as tugs; and furthermore, the first never made its appearance upon that canal. It was the vessel constructed twelve years afterwards for Lord Dundas, which was designed to be used for dragging shipping: a purpose which, on several occasions, she satisfactorily and successfully executed.

It has been attempted to represent the whole of these experiments as failures; but too much respectable and unquestionable evidence can be adduced in their favor to render any hostile assertions likely to be either accredited or believed—the more especially, as many practical well-informed engineers have declared their conviction that the machinery was well contrived, and its mode of application most ingenious. Indeed, the declaration may at once be hazarded, that in several important points it possessed many advantages over that which is even at present employed; and it may also be averred, that to be more highly prized, it needs but to be better understood.

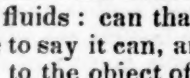
As a proof of Mr. Symington's ingenuity, and of the obstacles which genius will surmount, may be mentioned, that although Mr. Hull's patent rights were said to have been prestrained, strictly guarded, and rigidly enforced, Mr. Symington invented and brought into use an improved steam engine, which was more simple, manageable, and economical for many purposes, than that of his celebrated contemporary and competitor, without, in the slightest degree, rendering himself liable to the charge of encroachment. And he gave still further evidence of inventive powers by *dismissing the beam*—a desideratum so important as to have called forth the following opinion from the writer of the article which has led to this communication: "And if the beam shall ever be dismissed, and a rotatory motion obtained, the triumph over inertia and friction will raise the wonder still higher."

On increasing the Facilities for Transportation by Water. By John N. Pomeroy. To the Editor of the Mechanics' Magazine.

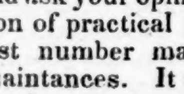
Sir—Although my acquaintance with you is very limited, I hope you will pardon the liberty I take in addressing you. My profession necessarily occupies a great portion of my time and attention; nevertheless, I am not indifferent to the progress of improvements which are going on at such an astonishing rate in our country. The wonderful facilities for rapid transportation afforded by the introduction of railroads, and its vast superiority, in velocity at least, to the modes of transportation on the natural water communications throughout the country, could not but excite the inquiry—"Is it true, then, that the various rivers and arms of the sea, which intersect the face of the earth, and which have been heretofore considered as great highways for the convenience of man, and designed as such—is it true that the progress of improvement is to prove these but *obstacles*, rather than *facilities?*" The present superiority of the railroad system would seem to indicate an affirmative answer to this question; but a reflecting mind would be unwilling to admit it, and would be led to inquire into the *reason* of the apparent superiority, and would, at all events, be induced to doubt the wisdom of man, rather than his Maker. What, then, is the reason why we cannot pass with equal (or with greater) facility and velocity through the water, as on the railroad? It is doubtless, chiefly, if not wholly, on account of the *law of resistance* to motion in fluids: can that be obviated? I do not hesitate to say it can, and will be. How? This leads me to the object of this letter, which is to describe a plan which I have invented for that purpose, and ask your opinion, and, through you, the opinion of practical men, of whom, I think, you must number many among your friends or acquaintances. It appears to me to obviate the difficulty above referred to; but is the plan *practicable?* or are there insuperable practicable objections to it? In order to give you an idea of the plan above mentioned, or machine, I may as well describe the one which I have made; first premising that the object is to have the *sustaining* part of the vessel the part which moves and *gives motion*. The machine which I have made is composed, first, of 25 tin cylinders, 8 inches long, 2 inches in



diameter, with caps at each end, water-tight, and a pivot also in each end, in the centre of the cap or head, say a half inch in length. These cylinders are connected together by a chain, composed of narrow strips of tin, having

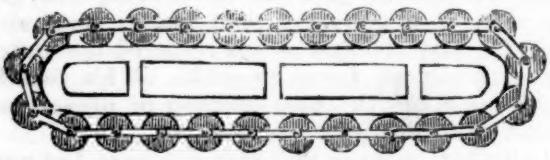


holes at each end, and placed on the pivots, so that the cylinders nearly touch each other, not



quite; and so that the cylinders can revolve

on the pivots without interfering. These cylinders, thus connected at each end, are made to inclose the *hull*, or boat, which is (as I have



made it for experiment) a frame about 18 inches long, 8¼ inches wide, and 4 inches in height or thickness, and so turned at each end as to admit an easy path for the cylinders, and also so that the cylinders may strike the water in a proper direction. There is a flange on the exterior edge, or circumference of the frame, to prevent the cylinders from rolling off. It will now be perceived, I think, that a force exerted on the pivots in the same direction, on any one or more of the cylinders, that it will give motion to the whole, and when placed in the water, the machine, sustained by the buoyancy of the cylinders, must move as fast *ahead* as the cylinders pass through the water to the *stern*. This power in my machine is applied to the pivots of the cylinders by two wheels, on a shaft, which passes transversely through the machine, and plays on gudgeons at each end—the wheels adapted by cogs to act on the pivots, and the shaft turned by a spring.

Now, what are the practical objections to the above? I admit the first impression must be unfavorable—it is, as a water-craft, entirely *unique*; but, appearances aside, it may be said that a vessel on this construction cannot be made sufficiently strong to sustain itself in rough water, without being too heavy to derive the benefit proposed from the cylinders. It appears to me that the form of the *hull* is well adapted for strength, without much weight. As to the cylinders, it is more doubtful. I have supposed a vessel made of about 100 feet in length, and 30 feet broad, 10 feet high between the two floors, having 60 cylinders or barrels, each 30 feet long, 5 feet in diameter, and having 25 barrels, say, in the water, which would be about the number. Now, 25 of these barrels, *entirely* immersed, would sustain 450 tons; and it appears to me that a vessel *complete* of this construction and size might be made considerably within the limits; and it is to be borne in mind, that, from its mode of progression, it would not conflict with rough water, as ordinary vessels do, as the impinging cylinders would rather '*nullify*' than make war with the opposing element. Would it not be *top-heavy*, and careen? I see no objection to its being made sufficiently broad to avoid this difficulty. Would it not be incommodious? I should judge not, but the reverse, as the rooms might be made square, high, and with sufficient windows at the sides; and I see no objection to having *guards*, a deck fore and aft the cylinders, and a promenade deck over the cylinders. Would it require more power to produce a given velocity than ordinary steamboats? I think very far less; but the cylinders, which are in the water, would be much impeded in their revolutions (which must be rapid) by the water. If this be a difficulty, it may be avoided by wheels on the pivots, or gudgeons of the cylinders, which should sustain the cylinders and revolve on their axes, leaving the cylinders to pass the water without revolving.

I do not flatter myself that I have nullified all objections which may be raised to the practicability of the above plan. What I have said is by way of suggestion; and having had the subject on my mind for two or three years, I am anxious to relieve myself, by getting the opinion of experimental and scientific mechanics, as to its practicability and probable utility. The same principle, I am inclined to think, may be applied to railroad cars with many advantages.

Very respectfully, yours, &c.

John N. Pomeroy.

On the Petrifying of Wood, as applicable to Timber for Railroads, &c. By G. [From the American Railroad Journal and Advocate of Internal Improvements.]

Some time since, in an eastern paper, there appeared an article stating that some person had discovered a method of completely petrifying wood, and so preserving it nearly or quite indestructible, by saturation with Hydrate of Lime. If any of your correspondents can furnish any information of the process, or any facts which may elucidate the subject, perhaps they might render an important service to the cause of railroads, in situations which require or admit the use of wood; and I would respectfully suggest to any who may recollect such facts, that the communication of them to the Railroad Journal would be a gratification to at least *one* of its readers—probably to many.

It is said that timber imbedded in lime, under certain circumstances, as, for instance, the ends of beams inserted in the walls of brick houses, decays sooner than in the open air—becomes dry rotten, &c. I have heard it argued that this is owing to the causticity, or some other quality of the lime; and to prevent the effect, it has been a practice, in some cases, to leave a space for the ends of the beams, large enough for the free circulation of air around them, and free from contact with the lime used in the construction of the walls. Whether the facts observed in these cases fully justify the conclusion that time is always, or ever, injurious to the durability of the timber, I would not venture to assert, and it is not my purpose now to inquire. I am willing to admit the conclusion that it *may* be so in some cases; but I would suggest the inquiry whether its causticity may not be so completely destroyed by saturation with water, and in this state whether wood may not be so far impregnated with it as to become much more durable, and perhaps next to indestructible.

The notice stated at the introduction of this article, if it may be relied on as fact, answers the inquiry in the affirmative. Of the fact, however, I am ignorant, and therefore it is that I make this communication and inquiry. My object is to excite others to further investigations, and

with this end in view, I beg leave to state some facts of which I have been informed, which seem to me to prove sufficiently that lime may, in *some* situations, be made to contribute very essentially to the durability of wood; and, perhaps, may suggest a remedy, to some important extent, for the disadvantages to which wooden railroads are obviously liable.

Some years ago, I was travelling on the seacoast of Maine, and put up for a night at the house of an elderly gentleman, who had been all his days concerned in ship-building and navigation, and appeared to be a sensible, shrewd observer. He had, that day, a new vessel arrived from her first voyage to a foreign port, and among other circumstances was told that she had not leaked a *drop* during the voyage. This led me to remark that she must have been exceedingly well built. He replied that he thought the tightness of the vessel was owing, in a measure, to the *lime* with which she had been stuffed while building. He had been led to believe that lime was a better preservative of the timber of ships than salt, or any other substance heretofore used for that purpose. While this vessel was being built, and before ceiling up the inside, he had the interstices of the timbers filled with new stone lime, pounded fine enough to be driven in between the timbers, and rammed in as solid as was possible in that state; the planking was then finished, and the lime left to slake and fill the remaining interstices. His theory was, that the air, and the moisture of the wood, and perhaps a little water, which might be expected to leak into the best built vessel, would slake the lime so that its expansion would fill every chink in the timbers, and penetrate the pores of the wood itself, sufficiently to prevent speedy decay; but any effect in rendering the vessel more staunch he had not anticipated. He, however, concluded that the expansion of the lime, though, from its small quantity, not sufficient to injure the vessel by its mechanical force, yet had been sufficient, by the addition of the little water which had leaked in, to form a mass of mortar so solid as to prevent, at least in some degree, the further ingress of water from without. This, however, was a new idea, and the present experiment was not conclusive; but as to its effect in preserving the timber, he had no doubt; and he related several facts in his own knowledge in support of this opinion.

As one instance, he stated that he had once owned a coasting vessel, built of the common timber of the coast of Maine, which, when nearly new, was once bound from Thomaston to Boston, with a cargo of lime, and on her passage went ashore somewhere between Cape Ann and Boston, and bilged. The lime slaked, burnt the deck and upper works, and, as might be expected, penetrated the timbers throughout. The vessel was unloaded, repaired, and lived, I think he said, thirty or forty years after this event; had undergone occasional repairs since, but the principal part of the original timber remained. When, after that that time, examined, it was found that the original timbers, which had been impregnated with the lime, were *perfectly sound*, while those which had been added *since* that time, were all, or nearly all, *rotten*. He adduced, also, the fact that vessels employed in carrying lime, generally, if not always, last longer than any others; and said that he had resolved thereafter to saturate, as far as possible, all his vessels with lime, as the best method of preserving them from decay.

Another instance was that of a parcel of pine planks which had been used as a platform, *on the ground*, on which to make lime mortar. This platform was laid by his grandfather, in a corner of the yard, and used more or less every year for the purpose of a "mortar bed." His father continued it in the same use; himself, the grandson, continued it for a time, as long as he had occasion; after which, it lay some years unused, and overgrown with grass and weeds; at length, wanting the ground for another purpose, he had it torn up and removed, expecting to find the planks entirely rotten—but, to his surprize, found them sound, and, to use his forcible expression, "as hard as a bull's horn." This was after they had lain in contact with the surface of the ground, exposed to all the vicissitudes of the atmosphere, I think he said, *about sixty years!*

It is now near 15 years since I received these accounts from the old gentleman, and I have never seen him since: my recollection, therefore, may not be perfectly accurate in the details of his statements, but of their *substance* I feel certain. When I saw the notice referred to in the beginning of this article, respecting the preservation of timber by means of hydrate of lime, these facts at once recurred forcibly to my mind, and I was led to the inference that, in the cases mentioned, there had been so much water present as to destroy the *caustic* properties of the lime, convert it to a *hydrate*, and hold so much of it in solution, and in such a situation, as that it might always be presented to the wood for its absorption, until it had become entirely saturated, and the wood thus effectually preserved.

Will some of your correspondents recollect, and furnish for publication in the Journal, such facts as may confirm or correct this inference, and trace out its legitimate consequences, if confirmed? G.

Safety Apparatus for Steam Boilers. By Alex. C. Twining. To the Editor of the American Railroad Journal, and Advocate of Internal Improvements.

Sir,—I have read several interesting articles in your Railroad Journal, the object of which was to propose one plan and another for protecting steam boilers against that danger of explosion which arises from the exposure of the flues to a violent heat when the water is permitted to descend below them. Respecting this hazard, (which is of frequent occurrence, as any man may be satisfied who takes time and pains to make extensive inquiries, and concerning which I speak reflectingly when I express the opinion that it subjects the traveller to more multiplied and more fearful risks than

any other circumstance attending the steam engine,) there can scarcely be too much discussion, until some adequate means of public safety in relation to it shall have been discovered and brought into common use. In this article I design to add one more to the proposed expedients for safety, after bringing up to view one or two principles which are necessary to a clear understanding of the precise object before us, and which are often overlooked by those who discuss this subject.

It is a principle, or, at least, it is a truth, which ought to take the place of a principle, not to be lost sight of on this subject, that mechanism, ever so excellent, cannot be made to supersede the practice of that same strict and personal examination by means of the gauge-cocks, which is now enjoined upon the engineer and other attendants of the engine. The propriety of this assertion will be understood by every one who is practically acquainted with the imperfection of materials, and knows that machines, put together according to the best rules of art and maxims of science, are subject, nevertheless, to irregularities, which, in mechanism for this purpose, though they occur but once in many years of time, do entirely prostrate the whole design. Nothing can be more simple, as a security against excess of steam in the boiler, than the present safety valve; yet, simple as it is, no one ventures to rely upon it without the attendant indications of the mercurial gauge; and if any arrangement equally simple shall ever be devised to meet the object now in question, as it is very probable there may, no wise man will rely upon it without the attendant indications of the gauge-cocks,—at least, until the construction of boilers shall make their explosions, when they do occur, altogether less destructive than they are at present. Indeed, if the vigilance and skill of those who are entrusted with the engine might be implicitly relied on, there would be little occasion for seeking any other safeguard: but *men* are scarcely less fallible than *mechanism;* and if the defects of this make it an uncertain dependence, the defects of the other ought, on the same principle, to teach us the necessity of providing a check against those causes of danger which do continually act,—such, for example, as deficient skill, or inattention, or drowsiness, or the use of spirituous liquors, or unforeseen accidental circumstances—causes that beset the passengers' way with dangers which a timely prevention generally disarms, but which sometimes give terrible demonstration that they are not imaginary. From such considerations we infer that no apparatus can do away with the necessity of that personal vigilance which is now the only dependence for safety—that the single end of an apparatus should be to provide a check upon those causes which make that first dependence sometimes to fail, and that such an apparatus is really most necessary, notwithstanding the opinions of many practical men to the contrary.

But, in forming such an apparatus, it should be a principle to make its indications of such a kind as to give the early notice of impending danger, not to passengers, but to those attendants on the engine whose business it shall be to apply the remedy. An opposite idea, it is true, has been incorporated into most of the current devices, for sounding or ringing alarms, or regulating moveable indices, open to the sense of all who may wish to gauge, at any moment, the precise dimensions of their travelling security. Not that bells or an index might not be so arranged as to give timely notice in the proper quarter only; but those projectors who have contemplated arrangements for indiscriminate alarm, have taken measures to defeat the success of their own projects, since experience has shown that the excitement and headlong impulses of a mass of people, acted on by the impression of impending danger, are almost as much to be dreaded as any common danger itself; and it is from their experience of this tendency, as well as from motives of immediate interest, and pride of personal feeling, that captains and proprietors would naturally discountenance every plan which would proclaim indiscriminately each momentary danger. The thing to be aimed at is to give notice when danger is at hand to those who have the means of averting it, and not at once to others; for, although it were ever thought a doubtful question whether passengers ought not at once to know the crisis, yet it is not a doubtful question whether captains and proprietors will readily consent that they shall; and still less is it doubtful respecting any specific means of safety, whether it will come into general use without the favor of those authorities.

These considerations, with others, led the writer many months ago to suggest to two or three individuals, of great skill in the steam engine, an arrangement for causing a small puff of steam to issue and alarm the engineer and firemen, in case the water should fall too low, while by others it would be undistinguished from the common sounds that now issue from the boilers, unless, indeed, the evil were permitted to continue uncorrected, in which case the increasing alarm would give indiscriminate notice of neglect and hazard. Since the time when those communications were made, an interesting article has found insertion in your Journal respecting a safety apparatus invented by Mr. Kennedy, of New-York, which, if I understand it rightly, embraces in its plan substantially the same idea. Mr. Kennedy, therefore, if that method of alarm shall be found to possess advantages sufficient to bring it into use, will be entitled to the merit of having first brought the idea up to public notice; though his particular arrangement, there is reason to fear, would fail of success, from a circumstance which deserves to be pointed out more specifically.

The circumstance alluded to, (and which, indeed, is common to most other plans that have been proposed for this object,) is that the rod, which connects Mr. Kennedy's float with his escape valves, is made to pass through the boiler in such a manner that this rod, or rather the "wadded stopper" which it works, is subject to the atmospheric pressure above, and

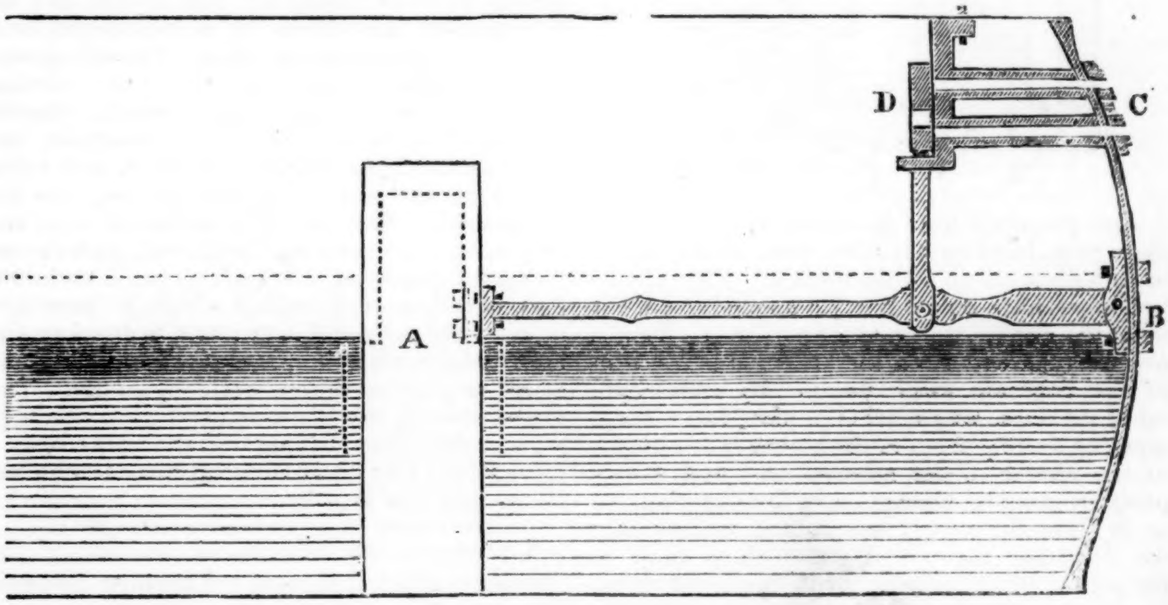
the steam pressure beneath; but as the atmospheric pressure is subject to changes equivalent to two inches of mercury, and the steam pressure in the boiler to changes much greater, it may be seen at once that a stopper of no more than one inch in area would be subject to influences which would of themselves greatly impair the accuracy of the indications of any float of moderate size. Add to this the friction of the stopper, which by reason of its packing must adhere to the tube with a considerable force, and there will be found in these three disturbing forces reason to apprehend a very capricious action of the float.

In my own arrangement, as well as the preceding, there are valves and a rod; but the rod is to work wholly in the steam, and is to be connected with the float by the intervention of a lever, which gives a considerable mechanical advantage,—say, an advantage of three to one. At the same time, packing is made unnecessary by the adoption of a metallic plate, working upon another plate in the manner of the common slide valve; but this will be more fully understood when we shall come to the figure and explanation.

None of the plans in your Journal, which I have noticed, except Mr. Kennedy's, have guarded against the uncertain amount of action in the float from its ebullition or foaming of the water. Mr. Kennedy has proposed a box, in which his float is to rise and sink; but I propose to accomplish the same object only by adapting the form of my float to that purpose, in the manner following: Suppose a float of the form and in the position of an upright cylinder, sunk just to touch the boiler at its lower end, or within an inappreciable distance of it, the water in which it floats being dead or free from ebullition; then when steam began to be generated, the water would swell in bulk and rise in height around the cylinder, but the upward pressure upon the cylinder's base would remain unvaried, since the specific gravity of the column above it is as much diminished as its height is augmented. The cylinder, therefore, would neither sink nor rise, but would retain its position unaltered until the absolute quantity of water in the boiler became itself altered. By adopting thus a cylindrical float, to sink in the dead water as near to the bottom as the requisite play of the float will admit, we may secure the necessary regularity of action. But, in case it should be inconvenient for the float to sink so deep, let us suppose the immersion to be only to a part of the water's depth—it may be one-third, or one-fourth—then, if the immersed cylinder suddenly break off in its shape to a less diameter at the water line, forming a smaller cylinder, resting immediately upon the larger, and united to it at the precise line of the water, and if the cross section of the smaller bear the same ratio, in area, to the cross section of the larger, that the immersion in dead water of the combined float bears to the average depth of dead water required in the boiler, such a float will be very nearly stationary when the water changes from its dead state to a state of violent ebullition, or foaming. By the principles of hydrostatics, it would be perfectly stationary if the density of the floating column of water in ebullition were alike from bottom to top; but this is not the case in reality, by reason of the bubbles of steam enlarging a little as they ascend, and the greater quantity of steam thrown up along the sides of the boiler establishing a superficial current from the sides to the middle. The variation from equal density, however, in the middle, is not great, and it is in favor of the float's descending too low when the water foams: which is on the side of safety. One of the gentlemen to whom I had communicated, in conversation, the principles of this apparatus, objected to hollow floats; that he had often in the actual trial found them unaccountably to fill with water. This result was doubtless occasioned by minute imperfections in the metal and workmanship, which did not manifest themselves until the float became subject to the steam pressure in the boilers, and to the corrosive action of the water and gases. These imperfections it may not be easy wholly to avoid; and the objection led me to adopt, in my proposed arrangement, a float entirely open at the bottom, which would always be emptied of water by the ascending steam, and its buoyancy kept unimpaired so long as there is occasion for its action.

Before leaving this subject, I will remark upon one mechanical principle, which, if real, possesses the greatest practical importance. The nature of the danger which is to be dreaded, in the case of a deficient supply of water in the boiler, is very generally understood—that is, if the water line descends below the flues, they become intensely heated, and when the water, either by ebullition or by injection through the supply cock, again reaches the incandescent metal, an immense quantity of vapor is immediately generated, which neither the safety valve can discharge, nor the boiler sustain. This is a common and satisfactory statement, and one which receives confirmation from the valuable experiments of Professor Johnson, of the Franklin Institute. There is, however, a mode of action in this vapor, and one which may be, in particular cases, of intense efficacy, that involves a mechanical effect additional to those above mentioned; and I embrace this opportunity of calling the attention of men of practical science in the steam engine, to the principle involved, as I do not remember ever to have met with it. It is well known that, if a charged gun barrel be so loaded as to leave a considerable space between the ball and charge, the piece will burst when fired. The French, and I believe the military rationale of the fact is, that the flame, reverberating from the ball back to the charge, creates a more perfect and sudden inflammation in the chamber than would otherwise take place. But, although this explanation does assign a real cause, we might ask whether the amount of gas thus suddenly evolved, can exceed that which was pent up in the same chamber, at the proof of the piece with double or even treble charges, and weight of ball? A more adequate cause might

be assigned, arising out of the established principles of re-action: for when inflammation of the charge takes place, the whole volume of gas, urged by a pressure equivalent to hundreds of atmospheres, rushes towards the muzzle of the piece; but when it meets the ball, there is a sudden check in the moving mass, which must re-act laterally upon the chamber in the manner of a shock or blow. The accumulated force which the gaseous material has been progressively receiving from its evolution to its impact on the ball, is brought to bear in one instantaneous impulse on the sides of the piece which cannot resist the momentum, and swells or bursts. A most able mechanician, the same who is engaged in conducting the gun factory of the late Eli Whitney, of New-Haven, informed me, not long ago, that, at one period of their inspections by the United States' officer, more than a hundred barrels were ruined by being swelled or burst at the chamber, from some cause most inexplicable to the artificers, till at length they made a ponderous rammer, to drive home the balls with most unerring certainty, and the mysterious effect was experienced no longer. Now, to apply this principle of force to the subject in hand, when, in the case supposed, the water, by ebullition or by injection through the supply cocks, reaches the incandescent metal, not only an immense volume of vapor is suddenly generated, but, being generated within narrow limits, it must rush on every side with great velocity, and reach the limits of its confinement with accumulated momentum, and a shock similar in kind (though vastly less in amount) to that experienced in the case of the gun barrel already dwelt upon. This principle of force is a real cause of rupture, of an unknown degree of efficacy, and one which ought not to be neglected by practical men; for it may sometimes occur, in consequence of the same mode of action, that even without a deficiency of water, but merely from excess of steam, our present means of safety may become a cause of explosion; for if an overstrained boiler were suddenly relieved from its state of undue tension by a hasty opening of the escape valves in full, the water, being of high temperature, would fly into steam, which, though not in volume too excessive for the boiler to bear, would certainly rush with an upward motion to the limits of the boiler, and encounter the resistance there with a shock which might prove fatal. In every such case the escape valves should be opened very gradually. This may possibly prove to be the explanation of the circumstances which have been accounted so mysterious, that boilers placed apart, and connected only by the steam eduction pipes, manifest a sympathy, through which, in case of rupture, a second boiler often follows the destiny of the first: for instance, in the late disaster of the New-England, which was caused, it is believed, by excess of steam, and not by deficiency of water, it cannot be supposed that the two boilers were so nicely matched in strength that a given pressure in the same instant shattered both; but it may be supposed that, when the first exploded, and pressure was thus taken off the second through the eduction pipes, water flashed into steam in quantities equal to the discharge through the vent opened through the pipes, and met the boiler, already strained to its limit, with a momentum which proved fatal. This idea is countenanced by the distinct, yet very contiguous, explosions of the first and second boilers in that unhappy disaster.



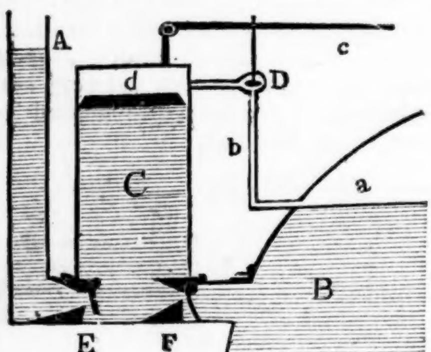
I now proceed to explain the prefixed figure, which is intended to represent a middle and vertical section made longitudinally through the boiler, and safety apparatus proposed and alluded to in the foregoing remarks. A B represent the lowest admissible water line; and the dotted line, above, the highest. At A is a cylindrical float, extending nearly to the bottom of the water; or, for the uniform cylinder, may be substituted the two cylinders combined in one float, as shown by the dotted figure at A. If this form be adopted, the lower cylinder must lie wholly immersed, when the water is free from ebullition, and the small-

er must be as much less in cross area as the depth of immersion is less than the depth of water, in order to counteract the effects of ebullition. The float which is adopted must be open at bottom, to admit steam; and tight at the top and sides. It is to be attached to a lever, A B, working vertically around a fixed axis at B, and carrying the slide D by means of the rod shown in the figure, which must be so attached to the lever as to allow a slight horizontal play at the point shown at the bottom of the rod. The water line being shown in its lowest admissible position, it will be seen that, if it descend lower, the orifice in the sliding piece at D will come into junction with the lower orifice C, and emit a puff of steam into the fire room; and the lower the water descends, the greater will the quantity of steam which is emitted become. But if so much water be injected as to raise the water line above the dotted line parallel to A B, the orifice D will come into junction with the upper orifice C, and steam will be emitted thence.

The subordinate fixtures and arrangements there is no necessity for explaining. I would only add, that every thing in this arrangement, of which I am the author, is at the service of every one who can use any part of it to advantage. I am, Sir, yours, respectfully,

ALEXANDER C. TWINING.

We annex the following plan, suggested by Mr. John S. Williams, of Cincinnati, Ohio:



The principle may be thus applied:—Place the water chamber (C) either against the boiler, or at a distance on a level with it. This chamber must have one valve (E) opened toward it from the supply water, and another (F) from it towards the boiler, on the principle of the seat of the common force pump. By an escapement, or three-way cock (D), placed in a small pipe (b) leading from a, the steam in the boiler, to the chamber, the atmospheric and steam pressure may be alternated in the chamber, so as to allow the supply water first to flow into the chamber through E, and then from it through F to the boiler. No force is required, except to work the very small escapement in the alternation pipe; and never while the supply water in A, and operation is kept up, will the water in the boiler rise higher or sink lower than the line a, above the level of which the chamber shall have capacity equal to the waste during the operation. d is a float to prevent condensation.

Or the same result may be produced, by placing the chamber C something higher than above described. Let the water in the supply pipe, reservoir, or cold water pump, A, be kept higher than the chamber C, which is furnished with valves, E and F, as before. Let the entrance of the alternation pipe, b, be exactly at the water line a in the boiler B. By means of the lever *c*, work the double puppet valve D up and down; or provide any means so as alternately to shut the steam and air out of the chamber C. This is all the power required. It is evident that if the water in the boiler should be lower than a, the chamber would pour in more than the water, and raise the water to a; but if the water should happen to be higher than a, no steam could pass through b to displace the water in C; and of course there would be no supply until the water would be evaporated down to a, where it would stand for ever, provided the supply water in A, and the opening and shutting of D, were continued. When the steam is down, the boiler might be filled through E and F.

If the chamber C were placed in the common condenser, and subject to the action of the escape steam, the necessary supply of water, and no more, would be heated.

One apparatus will supply any number of *connected* boilers; but should one be attached to each boiler, and the boilers unconnected, a boat might be ever so much, or ever so long listed, without a possibility of the water being more exhausted in one than in another; and no more sediment would be collected in one boiler than in another. If, in addition to this, were each boiler furnished with a valve in the steam pipe, opening toward the cylinder, the following benefits would be the result of the arrangement. A weak boiler or flue would not be subjected to the strain of an accidental surcharge of steam in another. Should a surcharge happen in one boiler, it would occupy the whole safety valve for its relief. Should one boiler burst, or a flue in one collapse, the others would not be affected by it, and not a stroke of the engine would be lost, but the remaining boilers would continue to work the engine as if nothing had happened, unless the bed were deranged. Were one boiler to burst, that, and that only, would exert its power to destroy the boat and crew, and to derange the bed: whereas by the present system, the force of all is exerted by an accident in one. The above results might be obtained from one supplying apparatus, having a branch pipe with a valve F and stop cock, running into each boiler, for its separate supply.

THRASHING BY STEAM.—A perusal of the following article, from the Fifeshire Journal, may afford our readers a subject to introduce a train of thought on the destined introduction of steam machinery into agriculture.

Steam thrashing machines are continually obtaining more favor among agriculturists, and when the greater convenience and increased cheapness of such an assistant on a farm are

taken into consideration, the preference given it over the mills now in use will not be a matter of wonder. A machine of four horse power will thrash about 60 bolls [240 bushels, we believe,] in a day, supposing the crop to turn out moderately well, and the consumption of fuel for this work is at the utmost 8 loads of small coal, at 7d. each, amounting to 4s. 8d.; the driving, *if very distant*, may take a pair of horses one day, which call 4s. more; the whole expenditure for the power of the machine would thus amount to 8s. 8d., taking it under the most unfavorable circumstances. A mill of the same power (worked by two pair of horses) will only thrash 30 bolls, if the cattle are not overdriven, and as the keep of each pair cannot be reckoned at less than 4s. per day, there will thus be nearly the same expense for power, with only half the quantity of work. But this is not the whole advantage of steam, for it is well known among farmers, that the heavy incessant drag of the thrashing mill is most injurious to horses, and causes more wear and tear in their constitutions than any other portion of their labor. If the usual contrivance is employed to make them all draw equally, a horse of less stamina than the rest soon suffers by it; and if they are allowed to pull, each in its own fixture, some of the spirited cattle do all the work, and are hurt by it. Nor is the convenience less in another point of view, for it often happens that a farmer finds it desirable to sell, when he can very ill spare his horses for thrashing, and is thus obliged either to lose the opportunity of making a good bargain, or to let some part of the work of a hurried season stand back to set the thrashing mill in motion. Farmers, who have had experience for some time of the steam engine, say that they could not, beforehand, have imagined the convenience it affords them; on a farm of four pair of horses, an engine of the power we have mentioned enables the farmer to do with three, and the remaining beasts, being no longer pulled asunder and exhausted by the heavy toil of the mill, are in better condition than before. Large machines, however, are no advantage, and we should think that any farmer in Fife would be sufficiently accommodated with one of four horse power. To thrash 56 or 60 bolls is surely expedition enough for the most active farmer, and more can hardly be necessary at any time. The large engines require a greater expenditure of coal to heat them and get up the steam, and as this is equally necessary, whether much or little work is to be done, a great deal of coal is lost on every occasion, where the quantity of stuff to be put through the mill is not considerable. The steam-engine of four horse power may cost about £100, or a little more, which is nearly £30 above the ordinary mill; but for this increased outlay, the cheapness of working is a complete and sufficient compensation. The subject is one which deserves the attention of landlords as well as tenants, and it will, if we are not mistaken, lead to still greater changes and improvements. If steam-engines were once common about farms, their agency would often be found useful for purposes which at present are not thought of, and the possession of such a disposable power, like a giant continually under his command, will enable the farmer to turn many things to advantage which are now neglected.

Novel Machinery.—A few days since we were permitted to examine the operation of a machine, propelled by steam, for manufacturing *hooks and eyes*. It is a little affair, that might nearly be packed away in a gentleman's hat; yet its regularity of motion, and the simplicity of its contrivance, in making those crooked things with the rapidity of the ticking of a watch, all fit for a lady's dress, called forth our highest admiration.

The turning of gun stocks, shoemakers' lasts, and ox yokes, besides several other queerly shaped every-day conveniences, with which the farmer, the soldier, and the mechanic, are familiar, must certainly be considered the *ne plus ultra* of native ingenuity.

There are several ponderous cast iron machines for sale in a loft in Broad street, the invention of a Yankee, for making common brass pins. A child, by turning a crank, for aught we can discover, might manufacture a bushel a day, all headed and pointed for use.—[Boston Tracts and Lyceum.]

Indigenous Animals.—It has been doubted whether red foxes, mice, rats, the common black fly, the Hessian fly, the honey bee, fleas, moths, bed bugs, and cockroaches, are indigenous to this country.

It appears that the unanimous testimony of the Indians is, that the red fox did not make its appearance until after the Europeans had settled the country, and this was after an extraordinary cold winter, when all the sea to the northward was frozen. Hence it has been inferred that it came over from the north of Europe or Asia on the ice. Another account is that a gentleman of fortune, in New-England, imported a number for the sports of the field, at the first settlement of that country, and that from this stock was propagated the race. It is well understood that our red fox is the same as that of the old world. Kamschatka abounds with them; and when Commodore Bering landed on the western coast of America, he saw several; and Lewis and Clarke also observed them on the west side of the Rocky Mountains. A very severe winter may have driven vast numbers from the regions of the north, into the lower country, about the time mentioned by the Indians, as it frequently has other animals, and particularly squirrels, deer, and bears. Severe cold produces famine, and famine causes the migration of men, as well as of other animals. Little credit is to be reposed in the opinions of savages on such subjects.

Almost all the other animals have proba-

bly been imported; but this does not disprove their being also aborigines of America. Fleas have been found on gray squirrels and rabbits, killed in desert parts of the country, where no human creature ever lived; and in new settlements made on pine lands they abound. The cockroach, or blatta orientalis, is said to have been imported from the West Indies; but, on the other hand, it has been found in the midst of woods and deserts. The common mouse and the rat have also been seen, at an early period, in the crevices of stones and subterranean grottoes in remote mountains, where no human being had ever been before. The black rat is probably a native of America, and the gray rat imported from Europe.—[Transactions of the N. Y. Lit. and Phil. Society.]

History of Astronomy—its various Systems.

[Continued from page 46.]

Respecting the light of the sun, little was known till the time of Sir Isaac Newton. Before his time light had always been esteemed a mere quality or modification of matter; but it is now generally believed to be a *real substance*, or distinct species of matter, emanating or flowing from some luminous body, although in exceedingly small particles. It is also known that these particles proceed from the luminous body in straight lines; but their velocity exceeds every species of motion with which we are acquainted.

The velocity of light is to the velocity of the earth in her orbit as 10,300 to 1, although she moves at the rate of 68,000 miles per hour; therefore light flies at the rate of 187,878 miles per second, which is about 1,550,000 times faster than a cannon ball. This prodigious velocity of the particles of light, if they were not exceedingly small, would prove fatal to our eye sight; for they would strike us with such force that our eyes could not bear the shock.

The time which light takes to arrive at the earth from the sun is 8′ 13″. This was discovered by Roemer, a Danish astronomer, in the year 1644. By comparing the eclipses of the first satellite of Jupiter with the times of its immersions and emersions, given by the tables of Cassini, he found that the error of the tables depended on the distance between Jupiter and the earth; and hence he concluded that the motion of light was not instantaneous, and that it moved through the diameter of the earth's orbit in about 11 minutes. This, though a sufficient discovery or proof of the progressive motion of light, was not accurate enough to determine its true rate of velocity. However, this was soon after discovered by Dr. Bradley to be what it is stated at above. The intensity of light and heat varies as the square of the distance: for if an object be placed one foot distant from a candle, and another two feet, the one that is two feet distant will only receive one fourth part of the light that the other does; and if it be removed to the distance of three feet, it will only receive one ninth part, and so on. It is the same with respect to the heat imparted to any body.

Of the Planet Mercury.—Mercury is the nearest planet to the sun, and performs his revolution round that luminary in the shortest period of all the planets.

The time he takes to perform his revolution is 87d. 23h. 14′ 32·7″*, which is the length of his year. The length of his day, or the time he takes to perform a revolution round his axis, is not known; for, by reason of his proximity to the sun, few observations can be made upon him. He is so near the sun that he can seldom be seen, and when he does make his appearance, his motion is so rapid towards the sun, that he can only be discerned for a very short time. When he can be seen, it is a little before the sun rises in the morning, and a little after he is set in the evening. His distance from the sun is 36,668,373 English miles, and his diameter is 3,241 miles, which makes him about one-fifteenth part of the size of the earth. The rate at which he moves in his orbit is not known. The light and heat he receives from the sun are seven times greater than the earth, and the sun appears seven times as large to him as to the earth.

This planet appears to us with all the various phases of the moon, when viewed at different times with a good telescope; but he never appears quite full, because his enlightened side is never turned directly towards the earth, except when he is so near the sun as to be lost to our sight in his beams. His enlightened side being thus always turned towards the sun, proves that he shines not by any light of his own; for if he did, he would always appear round and fully enlightened. It is also plain he moves in an orbit within that of the earth's, because he is never seen opposite to the sun, nor above 56 times the sun's breadth from him, his greatest elongation being about 28°. In heathen mythology, Mercury is styled the Messenger of the Gods.

Of Venus.—Venus is the next planet in

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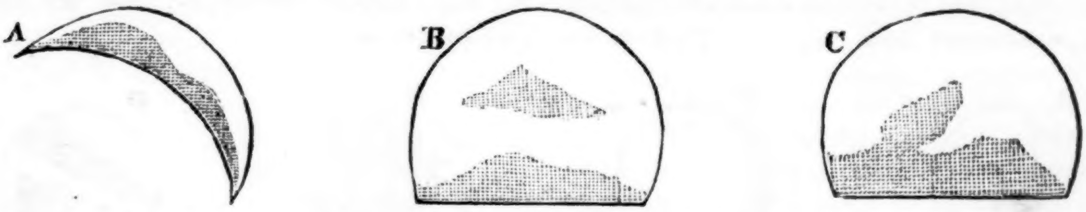
* The time which any planet takes to perform its revolution round the sun, is called the length of its year; and the time which it takes to revolve round its axis, the length of its day.

order, and computed to be 68,518,044 English miles distant from the sun. She moves at the rate of 76,000 miles per hour; and completes her revolution round the sun in 224d. 16h. 41′ and 28″.

The time she takes to revolve round her axis, or the length of her day, is by some astronomers stated at 23h. 21′, and by others at 24h. 8′. Venus is much about the size of our earth, her diameter being 7,687 miles. When examined by a good telescope, she exhibits the same phases as Mercury and the moon; and her surface is occasionally variegated by darkish spots. These spots were employed by Cassini and Bianchini in determining the revolution of Venus about her axis.

In the following figure A represents Venus, according to the late Sir William Herschel, and B C according to Shroeter.



Venus is never seen opposite to the sun, nor more than 96 times the breadth of that luminary from his centre, her greatest elongation being about 47°, which proves that her orbit includes that of Mercury. When Venus is to the west of the sun, she is to be seen before the sun rises, and is then called the morning star; when she is east of the sun, she is to be seen after he sets, and is then called the evening star. Venus is in each of these situations for 290 days together. This may at first seem surprising, that she should keep longer on the east or west side of the sun than the whole time of her revolution round him. But when it is recollected that the earth is all the while going round the sun the same way, though not so quick as Venus, the difficulty vanishes. For the relative motion of Venus to the earth must, in every period, be as much slower than her absolute motion in her orbit, as the earth during that time advances forward in the ecliptic, which is 220 degrees. To us Venus appears brightest when her elongation is about 40 degrees, both before and after her inferior conjunction.

Some astronomers have imagined that they perceived a satellite near Venus; but this has since been proved to have been an illusion; for in her transit over the sun's disc, she appeared unaccompanied by any satellite.* Mr. Ferguson thinks Venus may have a satellite revolving round her, though it has not yet been discovered; and adds "that this will not appear very surprising, if we consider how inconveniently we are placed for seeing it."

Of the Earth.—The earth performs its revolution round the sun in an orbit between that of Venus and Mars, at the distance of 95,173,000, in 365 days, 5 hours, 48 minutes, 49 seconds, which is called the solar or tropical year. In performing its annual circuit, the earth travels at the rate of 68,000 miles every hour, which is 140 times faster than that of a cannon ball. The diameter of the earth is 7,912 English miles, and its circumference 24,855·42 miles.* That the earth is round, like a globe, is evident from its shadow in eclipses of the moon: for, 1st, the shadow is always bounded by a *circular* line, although the earth be constantly turning its different sides to the moon; 2d, by people at land only seeing the upper part of the mast of a ship when she first comes in sight, and as she approaches the land the whole of her gradually becoming visible; 3d, by its having been sailed round by many navigators. Several degrees of a meridian circle on the earth's surface have been measured in different parts, by which it has been discovered that a degree is longer at the poles than at the equator, and therefore the true figure of the earth is that of an oblate spheroid, the equatorial diameter exceeding that of the polar by 26¾ miles. This deviation from the real spherical shape is occasioned by the diurnal rotation on its axis; for the gravity of the equatorial parts is diminished by the centrifugal force arising from their rapid motion, while the gravity at the poles suffers no diminution.

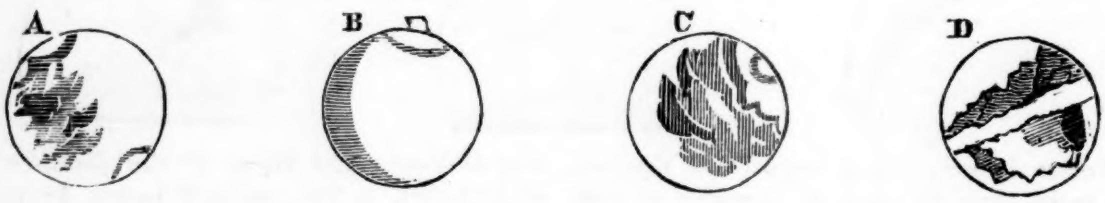
Of Mars.—The planet Mars is 4,142 miles in diameter, and performs his revolution round the sun in 686 days, 22 hours, 18 minutes, at the distance of 144,588,575 miles. His motion in his orbit is about 55,000 miles per hour. The time he takes to revolve round his axis is 24 hours, 39 mi-

* A transit of Venus happens very seldom. Only two occurred in the last century; one in 1761, and the other in 1769. There is not to be another till the year 1874. Transits of Mercury happen much oftener. There was one of this planet in 1822; but it was not visible in Britain.

* This is what the French mathematicians have lately deduced from a measurement of above 12° of the meridian.

nutes, of our time. The quantity of light and heat which Mars enjoys is only equal to half what the earth enjoys; and the sun only appears to him half as large as to the earth. This planet being only about a fifth part of the size of the earth, if any satellite attends him, it must be very small, and has not yet been discovered. To Mars, the earth and moon appear like two moons, a larger and a smaller, changing places with each other, and appearing sometimes horned, and sometimes half or three-quarters enlightened, but never full; and never above a fourth part of a degree distant from one another, although they are 240,000 miles asunder. Mars is very remarkable for the red color of his light, and for the great number and variety of spots which mark his surface.

The following figures, A, B, C, and D, represent the different appearances of Mars as seen by the late Sir W. Herschel, through the astronomical telescope; they are therefore inverted.



The atmosphere of this planet, which astronomers have long considered as of an extraordinary size and density, is the cause of the singular redness of its light.

When observed by a good telescope, Mars sometimes appears gibbous, or more than half, but never horned, which shows that his orbit includes the earth's within it, and also that he does not shine by any light of his own.

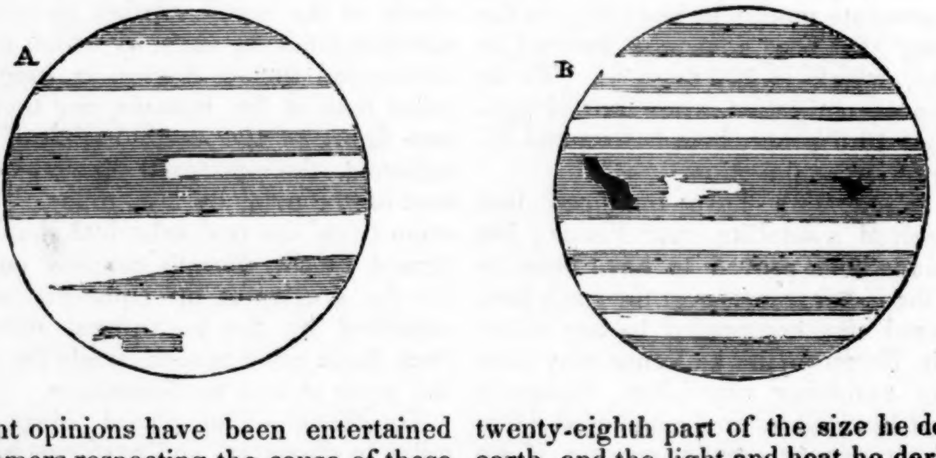
In heathen mythology, Mars is styled the God of War.

Of Jupiter.—The planet Jupiter is the largest of all the planets, his diameter being 89,170 English miles. The time he takes to perform his revolution round the sun is 4330 days, 14 hours, 39 minutes; but his motion round his axis is extremely rapid, being completed in the short space of 9 hours, 55 minutes. His distance from the sun is stated at 492,665,207 English miles; and his hourly motion in his orbit at 25,000 miles.

The form of Jupiter, like that of the earth, is an oblate spheroid, the equatorial diameter being to the polar as 14 to 13.

When this planet is examined through a good telescope, several belts or bands are perceived extending across his disc, in lines parallel to his equator.

These belts are variable, both in number and position. The following figures, A, and B, exhibit the appearance of Jupiter, according to Sir W. Herschel.



Different opinions have been entertained by astronomers respecting the cause of these belts. By some they have been regarded as clouds, or as openings in the atmosphere of the planet; while others imagine them to be of a more permanent nature, and to be marks of great physical revolutions, which are perpetually changing the surface of the planet.

The sun appears to Jupiter only of one twenty-eighth part of the size he does to the earth, and the light and heat he derives from that luminary are in the same proportion. But he is in some measure compensated for this want by the quick return of the sun, occasioned by the prodigiously rapid motion round his axis; and by four satellites which move round him, at different distances.

These four satellites were discovered by Galileo, an Italian astronomer, in the year

1610. They may be seen by a telescope which magnifies thirty times, and are found to be of great use in determining the longitude of places on the earth, by their immersions into his shadow, and their emersions out of it.

These satellites are of different magnitudes; the second being the least, the third the greatest, and the fourth the *second* in magnitude. The time which each of these satellites take to go round Jupiter is as follows: The first, or nearest to him, 1d. 18h. 27′ 33″; the second, 3d. 13h. 13′ 42″; the third, 7d. 3h. 42′ 33″; and the fourth, 16d. 16h. 32′ 8″.

The eclipses of these satellites, by falling into the shadow of Jupiter, have not only been of advantage in enabling astronomers to ascertain the longitude of places, but were the cause of that most curious discovery, made by Roemer, in the year 1675, of the successive propagation of light.

On Mechanics' Institutes. By S. Blydenburgh. To the Editor of the Mechanics' Magazine.

Sir,—I examined with peculiar satisfaction the report of the Mechanics' Institute of the city of New-York, which was handed me by your friend Mr. Walsh, having long felt a deep interest in the subject of association for the purpose of improving and increasing the stock of knowledge among practical mechanics, on subjects connected with the useful arts. It is by the help of this knowledge alone that man is changed from the savage to the civilized state, and every step it advances is a commensurate advance in civilization. It must be obvious to every reflecting mind, that the progress of improvement in the arts has been in amazingly different ratios at different periods, and under different circumstances; and it must be equally obvious that the causes which have more than all others accelerated that progress, are liberty and association. It is no less true than worthy of observation, that where any number of persons associate for the purpose of mutually gaining and communicating knowledge, on any subject, the stock of knowledge is increased nearly as the square of their numbers. How important then must it be, that men should adopt that course which is, of all others, the best calculated to promote that cause which is the most essential to the temporal happiness of mankind.

The stock of human knowledge in the useful arts is an accumulation through successive ages of experience, from time immemorial; but much of this stock has been lost by want of association, and through an erroneous policy. Each important discovery was kept secret, and either cautiously transmitted to the descendants of the discoverer, as a sacred *arcanum*, or died with him. But whether public or private, those discoveries were of little use in promoting general happiness. The ingenuity and the labor of the human family were considered as equally the property of the tyrant who governed it; and both were exclusively appropriated either to pamper his pride while living, or to perpetuate his name when dead. The more he could depress his fellow creatures the greater was his relative elevation above them. When we reflect, therefore, on the stupendous grandeur and exquisite workmanship still visible in the ruins of antiquity, instead of regretting the fancied degeneracy of human intellect, we ought to consider that those monstrous fabrics were constructed by the labor of slaves, and the ingenuity which beautified them was rewarded by the hard earnings of wretches, deprived thereby of the comforts of life. No wonder that arts were then kept secret, and died with their inventors.

Science was then of no use to the practical artist, nor even to any body else. Indeed, all it could boast was mere hypothetical speculations, which served only to gratify idle curiosity, or to aid the power of magical delusion, in producing mental slavery, more degrading and more to be dreaded even than physical. These reflections will at once account for the amazing and almost inconceivable displays of human ingenuity, since the spirit of liberty has awakened the dormant powers of genius by its vivifying influence.

Science and art are twin sisters, designed by nature for the mutual benefit and support of each other; but, by the above causes, they have been alienated and estranged from each other through the entire lapse of past ages, until the present auspicious era has reconciled and united these two, so useful to each other. Science has now become convinced that she not only owes her discoveries principally to the assistance of art, but that it is art which furnishes her with the substantial comforts of life. Art has also discovered that the light of science opens to her view a road to perfection, towards which she was only groping her way in darkness.

It now begins to be understood by men of discernment, that a knowledge of practical things would be of more use to the rising generation than the course of education now pursued in our highest seminaries of learning—that they would be more benefitted by

studying the useful arts, aided by the light of science, than by spending those years in studying dead languages, which ought to be employed in acquiring ideas. Our young men, also, begin to be aware of this important truth, and to feel the influence of the spirit of improvement. Nothing is now wanting but to nurse the incessant spark which is kindling—to aid the first impulses of inquiry by such publications as you are now engaged in; and we shall soon find that the age of improvement is but dawning, and that the amazing displays of art and ingenuity, we have already seen, are but a faint prelude to advances yet to come.

But as we have yet no schools where science and art are blended and taught in their proper relation to each other, the desired object can only be attained by association. By this, not only the young men of our county, but even their seniors, can unite their efforts, and by interchanging ideas, put their joint knowledge into common stock, and also by their joint contributions meet expenses in books, reports, apparatus, and lectures, which would be generally beyond the reach of individuals. The example of the metropolis might be followed in every county in the state, and those branches communicating with the parent association, and with each other, would become a system of mutual aid and improvement between each individual branch and all the rest.

To excite a disposition to commence so desirable an object, many ways may be devised by yourself and your correspondents. Among others, I think it would not be improper for the institute to order its secretary to forward a copy of its constitution to some suitable person in each county; and, could it be obtained, an address from the society on the subject would no doubt have a salutary effect. With strong hopes that so useful an object will be effected, I will trespass no longer on your patience, or that of your readers. S. Blydenburgh.

Lansingburgh, Jan. 21, 1834.

We are much gratified that our esteemed correspondent has taken up this matter in good earnest. We were among the very first originators of institutions of this kind in England; and knowing, as we do, the great benefits that have arisen from their introduction there, we shall be proud in rendering any service in our power towards their promotion in this country. We hope that Mr. Blydenburgh will exert himself to establish them in his immediate vicinity, and shall be happy to give publicity to his successful efforts, in the hope that it will stimulate others to "go and do likewise."

Drill Machine—Important Improvement.—Last year Mr. John Geddes, farmer and joiner, Cargen bridge, who some time ago received, from the Highland Society of Scotland, a handsome premium for the best turnip drill-machine now in use, invented an apparatus for sowing and harrowing, which weighs 50 lbs., may be purchased for the same number of shillings, and is so exceedingly handy that it can be attached in five minutes to a common plough, and set in motion to the astonishment of the sheeted seedsman, and his friend the harrower, who foresee in this invention their occupation gone, with the exception of oats, and that too in the course of a few years. In the first instance, our friend drilled a field of barley, at the rate, not of 5, but 1½ bushels of seed per acre, and reared, notwithstanding, a full and fair average crop, and the calculation is that 12 shillings per acre for wheat and 10 shillings for barley may be saved on all the arable land in the country, placed under these descriptions of crop. Something, too, is gained in appearance: a succession of rows beautifully straight has a pleasing effect, and the opinion gains ground, that wheat thus raised will be easier reaped, and less liable to be lodged during wet weather. It is difficult to describe machinery in the absence of cuts; and all we say is, that the weight of the plough, by pressing on a wheel connected with the seed chest, causes it to revolve, and opens the valves with the greatest regularity. A small coulter ruts the soil to the proper width and depth, and no more; and two iron teeth, like the teeth of harrows, cover up the tiny drill, and complete the operation. From the position of the seed-box, nothing is trodden under foot: by reason of the wheel below the plough, the task of the horses is not harder than in ordinary cases, and a man, or even a lad, can plough, sow, and harrow, at the rate of one acre per day, or more. From the great breadth of oats planted, and the necessity which exists of breaking the stubborn glebe during winter, broadcasting this description of crop must still remain the favorite mode of husbandry; while, on the other hand, wheat and barley, from the success of the experiments already made, must, ere long, be drilled almost universally. By modifying the seed-chest and substituting one for another, according to the nature of the operation, potatoes may be planted, and beans

and peas sown on the same principle. By means of an index, the quantity of seed required to be sown is regulated with mathematical accuracy, and can be increased or diminished according to circumstances.—[Dumfries Courier.]

History of Chemistry. [Continued from page 43.]

Silver.—Silver was known to the nations of antiquity. Its discovery is of an earlier date than the most ancient records of mankind; and it soon became, by its scarcity, its beauty, and its useful properties, the object of the researches of a great number of artists and men of science. It is not astonishing that men who had caused the metallic substances to assume so many different forms, and who so frequently imitated by alloys the whiteness and several of the properties of silver, harbored from a very remote period the idea of creating this precious metal by art. When they compared it with the other white metals, it seemed to them to differ from them only in some qualities, and that it would not be impossible to procure it free from those qualities. Not discouraged by their first unsuccessful attempts, in proportion as this precious metal became amongst mankind the representative of all other objects, of all the productions of industry, and even of those of genius, the alchemists redoubled their efforts; and though their experiments and their laborious researches have not had all the success which they expected from them, they have not been entirely lost. It is from these unfortunate trials, accumulated by the labors of ages, that chemists have derived the facts which they have employed in its history; and they have had, as it were, nothing more to do than to arrange, in a methodical order, and clearly to describe, the phenomena which this metal had presented, in the tortures of every kind to which alchemists have subjected it.

Whilst the alchemists, who called silver *Luna* or *Diana*, qualified it even by the sign which they consecrated it to, as a kind of semi-gold, which they represented by two semi-circular lines put together in the same direction, with the horns turned to tbe left; so that nothing more was necessary than to turn back the interior curve, and unite it with the exterior in order to form the circular figure, or characteristic sign of gold, to which they believed it to be, in fact, very nearly related, since it was only required to develope one of its parts, in order to cause it to pass into the state of gold, the last stage of metallic perfection. The labors of the alchemists have extended its numerous uses, and have been no less useful to the chemists in constructing the system of their science. The pharmaceutical operations themselves, though they have been much less numerous upon silver than upon many other metals, have served to increase the stock of chemical knowledge concerning this metal; and it is from the whole of these labors that the history of this important metal has gradually been formed.

Silver is of a fine white color, and of an extremely lively brilliancy. Whether burnished or otherwise, this metal is the most beautiful that is known, at least in the opinion of most men. In general, it pleases more than any other metallic substance. There is no metal that approaches it in lustre; it holds only the fifth rank amongst the metals with respect to density and specific gravity; it follows after platina, gold, tungsten, mercury, and lead. Its specific gravity is 10·474 when melted, and 19·535 when hammered.

With respect to its hardness, it has been placed between iron and gold; this is, however, augmented by the action of the hammer, or by pressure. Its elasticity is pretty considerable; and in this respect it is intermediate between gold and copper. It is one of the most sonorous metals, and when struck it emits a very acute sound.

The ductility of silver is one of its most marked properties; it follows immediately after gold and platina. It is made into leaves so thin, that they are easily wafted away by the wind, and into wires of extreme tenuity. On this account it is instanced in Natural Philosophy to prove the divisibility of matter. A grain of silver may be sufficiently extended, and at the same time sufficiently firm to make an hemispherical vessel to contain an ounce of water, or a wire 400 feet in length. It is upon this amazing malleability that the art of gold and silver beating is founded. It holds the second rank after gold, with respect to tenacity, or resistance against breaking. A wire of this metal, one tenth of an inch in diameter, supports a weight of 270 pounds before it breaks. This wire is considerably lengthened before it breaks. Silver is hardened by all kinds of pressure; but it easily acquires its former ductility again by the action of fire, or by annealing.

Silver is a very good conductor of caloric, and becomes heated very quickly. Its expansion by heat is a little inferior to that of lead and tin, and superior to that of iron. When silver has been expanded by heat, and the fire urged till it is heated to white-

ness or incandescence, it softens and runs. Its fusibility has been estimated by Mortimer at 1000 degrees of Fahrenheit. When silver has been fused and suffered to cool slowly, it presents at its surface figures similar to net-work and fern leaves, which announce a very marked crystallizability. On breaking it we find a granulated texture, which possesses the same property. Mongez and Tillet, by suffering a liquid portion to run off from a large mass of fused silver, have obtained it crystallized in quadrangular or octahedral prisms; and it affects the same form in nature, as will be afterwards noticed.

Silver is a very good conductor of electricity and galvanism. It has no sensible taste nor smell; neither does it produce any effect upon the animal economy; and though it cannot be considered as dangerous to the health, it must, nevertheless, be reckoned amongst the number of perfectly inert substances destitute of any medicinal property.

Nature presents silver neither in such abundance, nor in so many places, nor in such large masses, as most of the other metallic substances. Even the number of species that can be distinguished amongst the ores of this metal is infinitely more limited than those which are admitted in most of the other metals. The mineralogists, who have hitherto considered its varieties as species, have moreover committed another error, namely, that of having too closely followed the errors and prejudices of the miners. These considering as ores of silver all those ores that are capable of affording this precious metal, of whatever nature they may be, which have very much obscured the natural history of this metal.

Pure silver, when exposed to the air, remains in it without alteration, except with respect to its polish and brilliancy; it becomes less shining and a little tarnished at its surface, but without being oxidized. We ought not, however, to confound the kind of covering or stratum of a deep blue color, which is formed upon old silver plate exposed for a long time to the contact of several gases mixed with the air, with a stratum which, according to the examination of it instituted by Mr. Proust, is merely a sulphuret of this metal. Silver has long been believed to be perfectly indestructible by the contact of the air, even when aided by a very intense heat; and on this account it was ranked amongst the perfect metals. Several chemists, and especially Junker, had advanced, that by treating silver by a long reverberation, and in a furnace where the flame circulated above the metal, the silver was at last converted into a vitriform oxide. It has even been added, that when united with mercury, and divided by this liquid metal, it was oxidized by the processes which are usually employed for converting mercury into red oxide, and which is not improbable.

Many experiments made since the assertion of Junker, and by different processes, have proved that silver is really oxidizable, but only that it is much less so, and with much greater difficulty, than the other metals. Macquer was the first who remarked this oxidation, by exposing silver in a crucible to the intense heat of the furnace of Sevres twenty successive times. At the last time, very sensible traces of oxidation were perceived, and a vitrification of an olive color. Macquer never failed to observe, when treating silver in the focus of a burning glass, that after a long incandescence, it became covered with a white powder which formed a stratum upon the support of the silver. Homberg, in the first experiments with the burning glass of Tchirshausen, had made the same observations upon silver and upon gold. It cannot be doubted that these facts indicate a marked oxidation of the silver, and that they become more strong and conclusive when joined with the experiments which we shall mention.

Van Marum made many valuable researches respecting the effects of electricity with the grand machine of Teyler, and found that it took fire and burned. By passing the electric shock from a battery through a wire of this metal, the wire is suddenly reduced, as it were, into powder, with a greenish white flame, which passes with the rapidity of lightning, and the oxide manifestly formed in this operation is dissipated in smoke. If we perform the same operation by wrapping up the wire, or fixing it upon white paper, it attaches itself to it in a very fine powder of a greenish grey color, so fine and so adherent, that it resembles smoke, or a light covering which cannot be separated from it again. It is impossible here to doubt either of the state of oxidation of the silver, or of its combustibility; because the phenomenon is constantly accompanied with flame. We may attribute this effect, which is not produced by ordinary fire, however intense it may be, to the extreme division of the metal by the electric shock, and to the high temperature produced by the electric composition in the body which is exposed to it. A stroke of lightning upon silver wires and silver furniture produces exactly the same phenomena, and is followed by the same results.

The oxide of silver formed by these dif-

ferent processes, and which is so difficult to be obtained, is likewise extremely easy of reduction, because the silver adheres to the oxygen very weakly. Though the presence of this body augments its weight, changes its properties, and especially renders it acrid and caustic, nothing more is required than to expose these greenish or yellowish grey oxides to the contact of the solar rays, in order to make them assume a darker color, become black, and approach to the metallic state. When we heat them in close vessels, and with the pneumatic apparatus, we obtain from them pure oxygen gas, and easily convert them into the brilliant and ductile metal, by fusing them in a crucible.

Neither carbon nor hydrogen have been combined with silver; but it combines readily with sulphur and phosphorus.

It is well known, that when silver is long exposed to the air, especially in frequented places, as churches, theatres, &c. it acquires a covering of a violet color, which deprives it of its lustre and malleability. This covering, which forms a thin layer, can only be detached from the silver by bending it, or breaking it in pieces with a hammer. It was examined by Mr. Proust, and found to be *sulphuret of silver*.

Silver does not combine with the simple incombustibles.

Silver combines readily with the greater number of metallic bodies.

When silver and gold are kept melted together, they combine and form an alloy, composed, as Homberg ascertained, of one part of silver and five of gold. He kept equal parts of gold and silver in gentle fusion for a quarter of an hour, and found, on breaking the crucible, two masses, the uppermost of which was pure silver, the undermost the whole gold combined with $\frac{1}{5}$ of silver. Silver, however, may be melted with gold in almost any proportion; and if the proper precautions be employed, the two metals remain combined together.

The alloy of gold and silver is harder and more sonorous than gold. Its hardness is a maximum when the alloy contains two parts of gold and one of silver. The density of these metals is a little diminished, and the color of the gold is much altered, even when the proportion of the silver is small; one part of silver produces a sensible change in twenty parts of gold. The color is not only pale, but it has also a very sensible greenish tinge, as if the light reflected by the silver passed through a very thin covering of gold. This alloy, being more fusible than gold, is employed to solder pieces of that metal together.

When silver and platinum are fused together, (for which a very strong heat is necessary,) they form a mixture, not so ductile as silver, but harder, and less white. The two metals are separated by keeping them for some time in the state of fusion; the platinum sinking to the bottom from its weight. This circumstance would induce one to suppose that there is very little affinity between them. Indeed, Dr. Lewis found that, when the two metals were melted together, they sputtered up as if there were a kind of repugnance between them. The difficulty of uniting them was noticed also by Scheffer.

Of Palladium.—This metal was first found by Dr. Wollaston combined with platina, among the grains of which he supposes its ore to exist, or an alloy of it with iridium and osmium, scarcely distinguishable from the crude platina, though it is harder and heavier. Palladium is of a greyish white color, scarcely distinguishable from platina, and takes a good polish. It is ductile and very malleable; and being reduced into thin slips, is flexible, but not very elastic. Its fracture is fibrous, and in diverging striæ, showing a kind of crystalline arrangement. In hardness it is superior to wrought iron. Its specific gravity is from 10·9 to 11·8. It is a less perfect conductor of caloric than most metals, and less expansible, though in this it exceeds platina. On exposure to a strong heat, its surface tarnishes a little, and becomes blue; but an increased heat brightens it again. It is reducible *per se*. Its fusion requires a much higher heat than that of gold; but if touched while hot with a small bit of sulphur, it runs like zinc. The sulphuret is whiter than the metal itself, and extremely brittle.

Nitric acid soon acquires a fine red color from palladium, but the quantity it dissolves is small. Nitrous acid acts on it more quickly and powerfully. Sulphuric acid, by boiling, acquires a similar color, dissolving a small portion. Muriatic acid acts much in the same manner. Nitro-muriatic acid dissolves it rapidly, and assumes a deep red.

Alkalies and earths throw down a precipitate from its solutions generally of a fine orange color; but it is partly re-dissolved in an excess of alkali. Some of the neutral salts, particularly those of potash, form with it triple compounds, much more soluble in water than those of platina, but insoluble in alcohol.

Alkalies act on palladium even in the metallic state; the contact of air, however, promotes their action.

A neutralized solution of palladium is precipitated of a dark orange or brown co-

lor by recent muriate of tin; but if it be in such proportions as to remain transparent, it is changed to a beautiful emerald green. Green sulphate of iron precipitates the palladium in the metallic state. Sulphuretted hydrogen produces a dark brown precipitate; prussiate of potash, an olive colored; and prussiate of mercury, a yellowish white. As the last does not precipitate platina, it is an excellent test of palladium. This precipitate is from a neutral solution in nitric acid, and detonates at about 500° Fahr., in a manner similar to gunpowder. Fluoric, arsenic, phosphoric, oxalic, tartaric, citric, and some other acids, with their salts, precipitate some of the solutions of palladium.

When strongly heated, its surface assumes a blue color; but by increasing the temperature, the original lustre is again restored. This blue color is doubtless a commencement of oxidizement; but neither the properties of the oxides of this metal, nor the proportion of oxygen with which it combines, have been ascertained.

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Palladium unites very readily to sulphur. When it is strongly heated the addition of a little sulphur causes it to run into fusion immediately, and the sulphuret continues in a liquid state till it be only obscurely red hot. Sulphuret of palladium is rather paler than the pure metal, and is extremely brittle. By means of heat and air the sulphur may be gradually dissipated, and the metal obtained in a state of purity.

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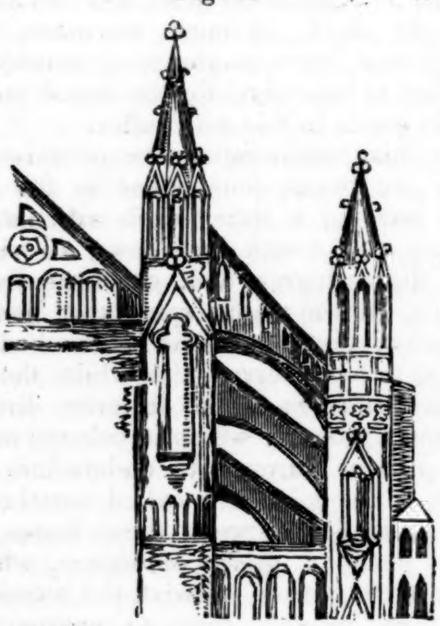
Fig. 5.



By all this, we see that if the skull is to be considered as an arch, and the parietal bones as forming that arch, they must be secured at the temporal and sphenoid* bones, the points from which they spring. And, in point of fact, where is it that the skull yields when a man falls, so as to strike the top of his head upon the ground?—in the temples. And yet the joinings are so secure, that the extremity of the bone does not start from its connections. It must be fractured before it is spurred out, and in that case only does the upper part of the arch yield.

But the best illustration of the form of the head is the dome.

A dome is a vault rising from a circular or elliptical base; and the human skull is, in fact, an elliptical surmounted dome, which latter term means that the dome is higher than the radius of its base. Taking this matter historically, we should presume that the dome was the most difficult piece of architecture, since the first dome erected appears to have been at Rome, in the reign of Augustus—the Pantheon—which is still entire. The dome of St. Sophia, in Constantinople, built in the time of the emperor Justinian, fell three times during its erection: and the dome of the cathedral of Florence stood unfinished 120 years for want of an architect. Yet we may, in one sense, say that every builder who tried it, as well as every laborer employed, had the most perfect model in his own head. It is obvious enough, that the weight of the upper part of the dome must disengage the stones from each other which form the lower circle, and tend to break up their joinings, and consequently to press or thrust outwards the circular wall on which it rests. No walls can support the weight, or rather, the lateral thrust, unless each stone of the dome be soldered to another, or the whole hooped together and girded. The dome of St. Paul's has a very strong double iron chain, linked together, at the bottom of the cone; and several other lesser chains between that and the cupola, which may be seen in the section of St. Paul's engraved by Hooker.

The bones of the head are securely bound together, so that the anatomist finds, when every thing is gone, save the bone itself, and there is neither muscle, ligament, nor membrane of any kind to connect the bones, they are still securely joined, and it requires his art to burst them asunder; and for this purpose he must employ a force which shall produce a uniform pressure from the centre outwards; and all the sutures must receive the pressure at one time, and equally, or they will not give way. And now is the time to observe another circumstance, which calls for our admiration. So little of accident is there in the joining of the bones, that the edge of a bone at the suture lies over the adjoining bones at one part, and under it at another, which, with the dovetailing of the suture, as before described, holds each bone in its place firmly attached; and it is this which gives security to the dome of the cranium.

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strong arched spines of bone, which give strength sufficient to permit the interstices of the groinings, if I may so term them, to be very thin. Betwixt the eye and the brain, the bone is as thin as parchment; but if the anterior part of the skull had to rest on this, the foundation would be insufficient. This is the purpose of the strong ridge of bone which runs up like a buttress from the temple to the lateral part of the frontal bone, whilst the arch forming the upper part of the orbit is very strong; and these ridges of bone, when the skull is formed with what we call a due regard to security, give an extension to the forehead.*

In concluding this survey of the architecture of the head, let us suppose it so expanded that we could look upon it from within. In looking up to the vault we should at once perceive the application of the *groin* in masonry; for the groin is that projection in the vault which results from the intersection of two arches running in different directions. One rib or groin extends from the centre of the frontal bone to the most projecting part of the occipital foramen, or opening on the back of the head; the other rib crosses it from side to side of the occipital bone. The point of intersection of these two groins is the thickest and strongest part of the skull, and it is the most exposed, since it is the part of the head which would strike upon the ground when a man falls backwards.

What is termed the base of the skull is strengthened, if we may so express it, on the same principle: it is like a cylinder groin, where the rib of an arch does not terminate upon a buttress or pilaster, but is continued round in the completion of the circle. The base of the skull is irregular, and in many places thin and weak, but these arched spines or ribs give it strength to bear those shocks to which it is of course liable at the joining of the skull with the spine.

CHAPTER II.

MECHANISM OF THE SPINE.—The brain case is thus a perfect whole, secure on all sides, and strengthened where the exposure to injury is the greatest. We shall see, in the column which sustains it, equal provision for the security of the brain; and what is most admirable, there is an entirely different principle introduced here; for whereas, in the head, the whole aim is firmness in the joinings of the bones, in the spine which supports the head the object to be attained is mobility or pliancy. In the head, each bone is firmly secured to another; in the spine, the bones are not permitted to touch; there is interposed a soft and elastic material, which takes off the jar that would result from the contact of the bones. We shall consider this subject a little more in detail.

The spinal column, as it is called, serves three purposes: it is the great bond of union betwixt all the parts of the skeleten; it forms a tube for the lodgment of the spinal marrow, a part of the nervous system as important to life as the brain itself; and lastly, it is a column to sustain the head.

We now see the importance of the spine, and we shall next explain how the various offices are provided for.

If the protection of the spinal marrow had been the only object of this structure, it is natural to infer that it would have been a strong and unyielding tube of bone; but as it must yield to the inflexions of the body, it cannot be constituted in so strict an analogy with the skull. It must, therefore, bend; but it must have no abrupt or considerable bending at one part, for the spinal marrow within would in this way suffer.

By this consideration we perceive why there are twenty-four bones in the spine, each bending a little; each articulated or making a joint with its fellow; all yielding in a slight degree, and, consequently, permitting in the whole spine that flexibility necessary to the motions of the body. It is next to be observed, that whilst the spine by this provision moves in every direction, it gains a property which it belongs more to our present purpose to understand. The bones of the spine are called vertebræ; at each interstice between these bones, there is a peculiar grisly substance, which is squeezed out from betwixt the bones, and, therefore, permits them to approach and play a little in the motions of the body. This grisly substance is inclosed in an elastic binding, or membrane of great strength, which passes from the edge or border of one vertebra to the border of the one next it. When a weight is upon the body, the soft gristle is pressed out, and the membrane yields: the moment the weight is removed, the membranes recoil by their elasticity, the gristle is pressed into its place, and the bones resume their position.

We can readily understand how great the influence of these twenty-four joinings must be in giving elasticity to the whole column; and how much this must tend to the protection of the brain. Were it not for this interposition of elastic material, every motion of the body would produce a jar to the deli-

* Although they are solid arches connected with the building of the cranium, and bear no relation to the surfaces of the brain, the early craniologists would have persuaded us that their forms correspond with the surfaces of the brain, and indicate particular capacities or talents.

cate texture of the brain, and we should suffer almost as much in alighting on our feet as in falling on our head. It is, as we have already remarked, necessary to interpose thin plates of lead or slate between the different pieces of a column, to prevent the edges (technically called arrises) of the cylinders from coming in contact, as they would in that case chip or split off.

But there is another very curious provision for the protection of the brain: we mean the curved form of the spine. If a steel spring, perfectly straight, be pressed betwixt the hands from its extremities, it will resist, notwithstanding it elasticity, and when it does give way, it will be with a jerk.

Such would be the effect on the spine if it stood upright, one bone perpendicular to another, for then the weight would bear equally; the spine would yield neither to one side nor to the other, and consequently there would be a resistance from the pressure on all sides being balanced. We, therefore, see the great advantage resulting from the human spine being in the form of an italic *f*. It is prepared to yield in the direction of its curves; the pressure is of necessity more upon one side of the column than on the other; and its elasticity is immediately in operation without a jerk. It yields, recoils, and so forms the most perfect spring; admirably calculated to carry the head without jar or injury of any kind.

The most unhappy illustration of all this is the condition of old age. The tables of the skull are then consolidated, and the spine is rigid: if an old man should fall with his head upon the carpet, the blow, which would be of no consequence to the elastic frame of a child, may to him prove fatal; and the rigidity of the spine makes every step which he takes vibrate to the interior of the head, and jar on the brain.

We have hinted at a comparison betwixt the attachment of the spine to the pelvis and the insertion of the mast of a ship into the hull. The mast goes directly through the decks without touching them, and the heel of the mast goes into the step, which is formed of large solid pieces of oak timber laid across the keelson. The keelson is an inner keel, resting upon the floor-timbers of the ship, and directly over the proper keel. These are contrivances for enlarging the base on which the mast rests as a column: for as, in proportion to the height and width of a column, its base must be enlarged, or it would sink into the earth, so, if the mast were to bear upon a point, it would break through the bottom of the ship.

The mast is supported upright by the shrouds and stays. The shrouds secure it against the lateral or rolling motion, and the stays and backstays against the pitching of the ship. These form what is termed the standing rigging. The mast does not bear upon the deck or on the beams of the ship; indeed, there is a space covered with canvas betwixt the deck and the mast.

We often hear of a new ship going to sea to stretch her rigging; that is, to permit the shrouds and stays to be stretched by the motion of the ship, after which they are again braced tight; for if she were overtaken by a storm before this operation, and when the stays and shrouds were relaxed, the mast would lean against the upper deck, by which it would be sprung or carried away. Indeed, the greater proportion of masts that are lost are lost in this manner. There are no boats which keep the sea in such storms as those which navigate the Gulf of Finland. Their masts are not attached at all to the hull of the ship, but simply rest upon the step.

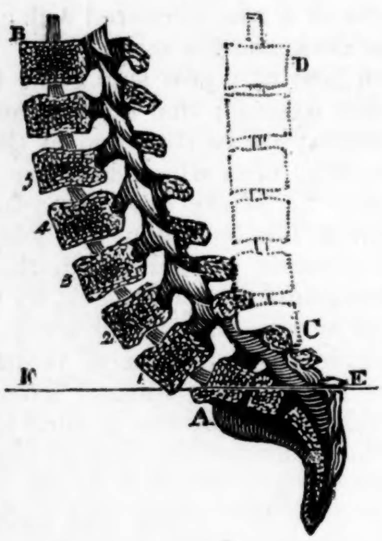
Although the spine has not a strict resemblance to the mast, the contrivances of the ship-builder, however different from the provisions of nature, show what object is to be attained; and when we are thus made aware of what is necessary to the security of a column on a moveable base, we are prepared to appreciate the superior provisions of nature for giving security to the human spine.

The human spine rests on what is called the *pelvis*, or basin: a circle of bones, of which the haunches are the extreme lateral parts; and the sacrum, (which is as the key-stone of the arch) may be felt at the lower part of the back. To this central bone of the arch of the pelvis, the spine is connected; and, taking the similitude of the mast, the sacrum is the *step* on which the base of the pillar, like the heel of the mast, is socketed or morticed. The spine is tied to the lateral parts of the pelvis by powerful ligaments, which may be compared to the shrouds. They secure the lower part of the spine against the shock of lateral motion or rolling; but instead of the stays, to limit the play of the spine forwards and backwards in pitching, or to adjust the rake of the mast, there is a very beautiful contrivance in the lower part of the column.

The spine forms here a semi-circle, which has this effect: that, whether by the exertion of the lower extremities, the spine is to be carried forward upon the pelvis, or whether the body stops suddenly in running, the jar which would necessarily take place at the lower part of the spine, A, if it stood

upright like a mast, is distributed over several of the bones of the spine, 1, 2, 3, 4, and, therefore, the chance of injury at any particular part is diminished.

Fig. 6.



For example, the sacrum, or centre bone of the pelvis, being carried forward, as when one is about to run, the force is communicated to the lowest bone of the spine. But then the surfaces of these bones stand with a very slight degree of obliquity to the line of motion; the shock communicated from the lower to the second bone of the vertebræ is still in a direction very nearly perpendicular to its surface of contact. The same takes place in the communication of force from the second to the third, and from the third to the fourth; so that before the shock of the horizontal motion acts upon the perpendicular spine, it is distributed over four bones of that column, instead of the whole force being concentrated upon the joinings of any two, as at A.

If the column stood upright, as indicated at C D, it would be jarred at the lowest point of contact with its base. But by forming a semi-circle A B, the motion which, in the direction E F, would produce a jar on the very lowest part of the column, is distributed over a considerable portion of the column A B; and, in point of fact, this part of the spine never gives way. Indeed, we should be inclined to offer this mode to the consideration of nautical men, as fruitful in hints for improving naval architecture.

Every one who has seen a ship pitching in a heavy sea, must have asked himself why the masts are not upright, or rather why the foremast stands upright, whilst the main and mizen masts stand oblique to the deck, or, as the phrase is, rake aft, or towards the stern of the ship.

The main and mizen masts incline backwards, because the strain is greatest in the forward pitch of the vessel; for the mast having received an impulse forwards, it is suddenly checked as the head of the ship rises; but the mast being set with an inclination backwards, the motion falls more in the perpendicular line from the head to the heel. This advantage is lost in the upright position of the foremast, but it is sacrificed to a superior advantage gained in working the ship; the sails upon this mast act more powerfully in swaying the vessel round, and the perpendicular position causes the ship to tack or stay better; but the perpendicular position, as we have seen, causes the strain in pitching to come at right angles to the mast, and is, therefore, more apt to spring it.

These considerations give an interest to the fact that the human spine, from its utmost convexity near its base, inclines backwards.

CHAPTER III.

Of the Chest.—In extending the parallel which we proposed between the structure of the body and the works of human art, it signifies very little to what part we turn; for the happy adaptation of means to the end will every where challenge our admiration, in exact proportion to our success in comprehending the provisions which Supreme Wisdom has made. We turn now to a short view of the bones of the chest.

The thorax, or chest, is composed of bones and cartilages, so disposed as to sustain and protect the most vital parts, the heart and lungs, and to turn and twist with perfect facility in every motion of the body; and to be in incessant motion in the act of respiration, without a moment's interval during a whole life. In anatomical description, the thorax is formed of the vertebral column, or spine, on the back part, the ribs on either side, and the breast bone, or sternum, on the fore part. But the thing most to be admired is the manner in which these bones are united, and especially the manner in which the ribs are joined to the breast bone, by the interposition of cartilages or gristle, of a substance softer than bone, and more elastic and yielding. By this quality they are fitted for protecting the chest against the effects of violence, and even for sustaining life after the muscular power of respiration has become too feeble to continue without this support.

If the ribs were complete circles, formed of bone, and extending from the spine to the breast bone, life would be endangered by any accidental fracture; and even the rubs and jolts to which the human frame is

continually exposed, would be too much for their delicate and brittle texture. But these evils are avoided by the interposition of the elastic cartilage. On their fore part the ribs are eked out, and joined to the breast bone by means of cartilages, of a form corresponding to that of the ribs, being, as it were, a completion of the arch of the ribs, by a substance more adapted to yield in every shock or motion of the body. The elasticity of this portion subdues those shocks which would occasion the breaking of the ribs. We lean forward, or to one side, and the ribs accommodate themselves, not by a change of form in the bones, but by the bending or elasticity of the cartilages. A severe blow upon the ribs does not break them, because their extremities recoil and yield to the violence. It is only in youth, however, when the human frame is in perfection, that this pliancy and elasticity have full effect. When old age approaches, the cartilages of the ribs become bony. They attach themselves firmly to the breast bone, and the extremities of the ribs are fixed, as if the whole arch were formed of bone unyielding and inelastic. Then every violent blow upon the side is attended with fracture of the rib, an accident seldom occurring in childhood, or in youth.

But there is a purpose still more important to be accomplished by means of the elastic structure of the ribs, as partly formed of cartilage. This is in the action of breathing, or respiration; especially in the more highly-raised respiration which is necessary in great exertions of bodily strength, and in violent exercise. There are two acts of breathing—*expiration*, or the sending forth of the breath, and *inspiration*, or the drawing in of the breath. When the chest is at rest, it is neither in the state of expiration nor in that of inspiration; it is in an intermediate condition between these two acts. And the muscular effort by which either inspiration or expiration is produced, is an act in opposition to the elastic property of the ribs. The property of the ribs is to preserve the breast in the intermediate state between expiration and inspiration. The muscles of respiration are excited alternately, to dilate or to contract the cavity of the chest, and, in doing so, to raise or to depress the ribs. Hence it is, that both in inspiration and in expiration, the elasticity of the ribs is called into play; and, were it within our province, it would be easy to show that the dead power of the cartilages of the ribs preserve life by respiration, after the vital muscular power would, without such assistance, be too weak to continue life.

It will at once be understood, from what has now been explained, how, in age, violent exercise or exertion is under restraint, in so far as it depends on respiration. The elasticity of the cartilages is gone, the circle of the ribs is now unyielding and will not allow that high breathing, that sudden and great dilating and contracting of the cavity of the chest, which is required for circulating the blood through the lungs, and relieving the heart amidst the more tumultuous flowing of the blood which exercise and exertion produce.

CHAPTER IV.

Design shown in the Structure of the Bones and Joints of the Extremities.—That the bones which form the interior of animal bodies should have the most perfect shape, combining strength and lightness, ought not to surprize us, when we find this in the lowest vegetable production.

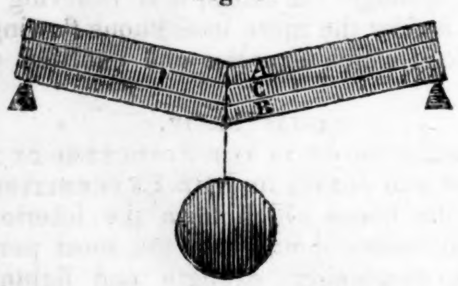
In the sixteenth century, an unfortunate man who taught medicine, philosophy, and theology, was accused of atheistical opinions, and condemned to have his tongue cut out, and to suffer death. When brought from his cell before the inquisition, he was asked if he believed in God. Picking up a straw which had stuck to his garments, "If," said he, "there was nothing else in Nature to teach me the existence of a Deity, even this straw would be sufficient?"

A reed, or a quill, or a bone, may be taken to prove that in Nature's works strength is given with the least possible expense of materials. The long bones of animals are, for the most part, hollow cylinders, filled up with the lightest substance, marrow; and in birds the object is attained by means (if we may be permitted to say so) still more artificially. Every one must have observed, that the breast bone of a fowl extends along the whole body, and that the body is very large compared with the weight; this is for the purpose of rendering the creature specifically lighter, and more buoyant in the air; and that it may have a surface for the attachment of muscles, equal to the exertion of raising it on the wing. This combination of lightness with increase of volume is gained by air cells extending through the body, and communicating by tubes between the lungs and cavities of the bones. By these means the bones, although large and strong, to withstand the operation of powerful muscles upon them, are much lighter than those of quadrupeds.

The long bones of the human body being hollow tubes, are called cylindrical, though they are not accurately so, the reason of which we shall presently explain; and we

shall at the same time show that their irregularities are not accidental, as some have imagined. But let us first demonstrate the advantage which, in the structure of the bones, is derived from the cylindrical form, or a form approaching to that of the cylinder. If a piece of timber, supported on two points, thus—

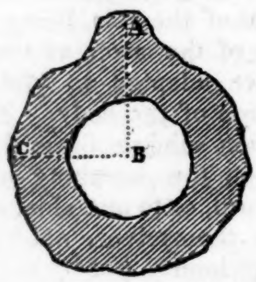
Fig. 7.



bearing a weight upon it, it sustains this weight by different qualities in its different parts. For example, divide it into three equal parts (A, B, C,): the upper part, A, supports the weight by its solidity and resistance to compression; the lowest part, B, on the other hand, resists by its toughness, or adhesive quality. Betwixt the portions acting in so different a manner, there is an intermediate neutral, or central part, C, that may be taken away without materially weakening the beam, which shows that a hollow cylinder is the form of strength. The writer lately observed a good demonstration of this: a large tree was blown down, and lay upon the ground; to the windward, the broken part gaped; it had been torn asunder like the snapping of a rope. To the leeward side of the tree, the fibres of the stem were crushed into one another and splintered, whilst the central part remained entire. This, we presume, must be always the case, more or less; and here we take the opportunity of noticing why the arch is the form of strength. If this transverse piece of timber were in the form of an arch, and supported at the extremities, then its whole thickness, its centre, as well as the upper and lower parts, would support weight by resisting compression. But the demonstration may be carried much farther to show the form of strength in the bone. If the part of the cylinder which bears the pressure be made more dense, the power of resistance will be much increased; whereas, if a ligamentous covering be added on the other side, it will strengthen the part which resists extension, and we observe a provision of this kind in the tough ligaments which run along the vertebræ of the back.

When we see the bone cut across, we are forced to acknowledge that it is formed on the principle of the cylinder; that is, that the material is removed from the centre, and accumulated on the circumference, thus:

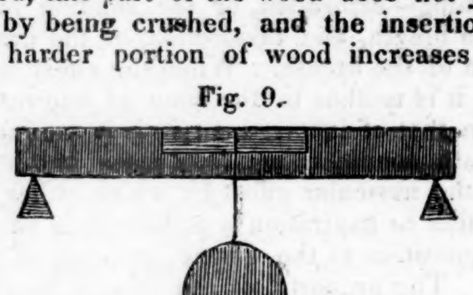
Fig. 8.



We find a spine or ridge running along the bone, which, when divided by the saw in a transverse direction, exhibits an irregularity, as at A.

The section of this spine shows a surface as dense as ivory, which is, therefore, much more capable of resisting compression than the other part of the cylinder, which is common bone. This declares what the spine is, and the anatomists must be wrong who imagine that the bone is moulded by the action of the muscle, and that the spine is a mere ridge, arising by accident among the muscles. It is, on the contrary, a strengthening of the bone in the direction on which the weight bears. If we resume the experiment with the piece of timber, we shall learn why the spine is harder than the rest of the bone. If a portion of the upper part of the timber be cut away, and a harder wood inserted in its place, the beam will acquire a new power of resisting fracture, because, as we have stated, this part of the wood does not yield but by being crushed, and the insertion of the harder portion of wood increases this

Fig. 9.



property of resistance. With this fact before us, we may return to the examination of the spine of bone. We see that it is calculated to resist pressure: first, because it is farther removed from the centre of the cylinder, and, secondly, because it is denser, to resist compression, than the other part of the circumference of the bone.*

* As the line A B extends farther from the centre than B C, on the principle of a lever, the resistance to transverse fracture will be greater in the direction A B than B C.

This explanation of the use of a spine upon a bone gives a new interest to osteology.* The anatomists ought to deduce from the form of the spine the motions of the limb; the forces bearing upon the bone, and the nature and the common place of fracture; while, to the general inquirer, an agreeable process of reasoning is introduced in that department, which is altogether without interest when the "*irregularities*" of the bone are spoken of, as if they were the accidental consequences of the pressure of the flesh upon it.

Although treating of the purely mechanical principle, it is, perhaps, not far removed from our proper object to remark, that a person of feeble texture and indolent habits has the bone smooth, thin, and light; but that Nature, solicitous for our safety, in a manner which we could not anticipate, combines with the powerful muscular frame a dense and perfect texture of bone, where every spine and tubercle is completely developed. And thus the inert and mechanical provisions of the bone always bear relation to the muscular power of the limb, and exercise is as necessary to the perfect constitution of a bone as it is to the perfection of the muscular power. Jockies speak correctly enough when they use the term "*blood and bone*," as distinguishing the breed or genealogy of horses; for blood is an allowable term for the race, and bone is so far significant, that the bone of a running horse is remarkably compact compared with the bone of a draught horse. The reader can easily understand that the span in the gallop must give a shock in proportion to its length; and, as in man, so in the horse, the greater the muscular power the denser and stronger is the bone.

The bone not being as a mere pillar, intended to bear a perpendicular weight, we ought not to expect uniformity in its shape. Each bone according to its place bears up against the varying forces that are applied to it.

Wonders of Art.—You behold a majestic vessel bounding over the billows from the other side of the globe; easily fashioned to float with safety over the bottomless sea; to spread out her broad wings, and catch the midnight breeze, guided by a slow drowsy sailor at the helm, with two or three companions reclining listlessly on the deck, gazing into the depths of the starry heavens. The commander of this vessel, not surpassing thousands of his brethren in intelligence and skill, knows how, by pointing his glass at the heavens, and taking an observation of the stars, and turning over the leaves of his "Practical Navigator," and making a few figures on his slate, to tell the spot which his vessel has reached on the trackless sea; and he can also tell it by means of a steel spring and a few brass wheels, put together in the shape of a chronometer. The glass with which he brings the heavens down to the earth, and by which he measures the twenty-one thousand six hundredth part of their circuit, is made of a quantity of flint, sand, and alkali—coarse opaque substances, which he has melted together into the beautiful medium, which excludes the air and the rain and admits the light,—by means of which he can count the orders of animated nature in a dew-drop, and measure the depth of the vallies in the moon. He has, running up and down his main mast, an iron chain, fabricated at home, by a wonderful succession of mechanical contrivances, out of a rock brought from deep caverns in the earth, and which has the power of conducting the lightning harmlessly down the sides of the vessel into the deep. He does not creep timidly along from headland to headland, nor guide his course along a narrow sea, by the north star; but he launches bravely on the pathless and bottomless deep, and carries about with him in a box a faithful little pilot, who watches when the eye of man droops with fatigue, a small and patient steersman, whom darkness does not blind, nor the storm drive from his post, and who points from the other side of the globe,—through the convex earth,—to the steady pole. If he falls in with a pirate he does not wait to repel him, hand to hand; but he puts into a mighty engine a handful of dark powder, into which he has condensed an immense quantity of elastic air, and which, when it is touched by a spark of fire, will instantly expand into its original velume, and drive an artificial thunderbolt before it, against the distant enemy. When he meets another similar vessel on the sea, homeward bound from a like excursion to his own, he makes a few black marks on a piece of paper and sends it home, a distance of ten thousand miles; and thereby speaks to his employer, to his family, and his friends, as distinctly and significantly as if they were seated by his side. At the cost of half the labor with which the savage procures himself the skin of a wild beast, to cover his nakedness, this child of civilized life has provided himself with the most substantial, curious, and convenient clothing, textures and tissues of wool, cotton, linen, and silk, the contri-

* *Osteology*, from the Greek words, signifying discourse on bone, being the demonstration of the forms and connection of the different bones.

butions of the four quarters of the globe, and of every kingdom of nature. To fill a vacant hour, or dispel a gathering cloud from his spirits, he has curious instruments of music, which speak another language of new and strange significance to his heart; which make his veins thrill, and his eyes overflow with tears, without the utterance of a word —and with one sweet succession of harmonious sounds, send his heart back, over the waste of waters, to the distant home, where his wife and his children sit around the fireside, trembling at the thought that the storm which beats upon the windows, may, perhaps overtake their beloved voyager on the distant seas. And in his cabin, he has a library of volumes—the strange production of a machine of almost magical powers—which, as he turns over their leaves, enable him to converse with the great and good of every clime and age, and which even repeat to him, in audible notes, the laws of his God, and the promise of his Saviour, and point out to him that happy land which he hopes to reach when his flag is struck, and his sails are furled, and the voyage of life is over.—[E. Everett.]

Rain Water.—In our country there falls rain, including melted snow, to the average depth of 35 inches. On a surface forty feet square, there falls yearly 34,909 wine gallons; and if all this were secured in cisterns, there would be nearly one hundred gallons for every day's consumption, or about three barrels. This water, if well preserved, would be the very purest and best for most domestic purposes. The horse and the cow prefer rain water to pump or well water; and though it would not be entirely governed by their decision, yet great respect is due to their judgment in such matters. The water of many wells is tinctured in such a way as to make it less fit for a solvent; and it does not so perfectly combine with nutritious substances, to form kyle, and nourish the human system. They who live in situations where water is not easily procured from the ground, may be told that the purest water is descending around them; and if they will only be at the necessary expense to secure this gift of heaven, they may provide an abundant supply. On such reservoirs the inhabitants of Palestine placed much dependence; and it is a merciful appointment of God, that in warm countries, where the greatest supply of water is needed, the most rain descends. We may yet find good capacious cisterns, of brick or stone, and Roman cement, economical additions to our domestic conveniences. A cistern ten feet square, and ten feet deep, would contain 118 hogsheads of 63 wine gallons each, and would secure to most families a constant supply of water.—[Scientific Tracts and Lyceums.]

Prize Medals to be awarded, for Discoveries in Science, by the Royal Society of London. [From the Journal of the Franklin Institute.]

Gentlemen,—I am directed by the American Philosophical Society to communicate to you, for publication, the annexed letter, received at their last stated meeting. The object of the Society is to diffuse the information given in that letter throughout the scientific community in the United States.

Very respectfully, yours,

A. D. Bache,

One of the Secretaries, Am. Philo. Soc.

Somerset House, Apartments of the Royal Society, London, Aug. 3, 1833.

Sir,—I am honored with the commands of His Royal Highness, the President of the Royal Society, to acquaint you, for the information of the American Philosophical Society, at Philadelphia, that His Majesty, the King, has been pleased to grant two gold medals of the value of £50 each, to be awarded by the Royal Society on the day of their anniversary meeting in each succeeding year, for the most important discoveries in any one principal branch of physical and mathematical knowledge.

His Majesty having graciously expressed a wish, that scientific men of all nations should be invited to afford the aid of their talents and researches, I am accordingly commanded by His Royal Highness the President to announce to you, sir, that the said Royal Medals for 1836 will be awarded in that year: the one for the most important unpublished paper on Astronomy, the other for the most important unpublished paper in Animal Physiology, which may have been communicated to the Royal Society for insertion in their Transactions, after the present date, and prior to the month of June, in the year 1836.

For the present, and the two following years, the Council of the Royal Society, with the approbation of His Majesty the King, have directed the Royal Medals to be awarded for important discoveries or series of investigations published within three years previous to the time of award; and those for the year 1833 have been adjudged, the one to Sir John F. W. Herschel, for his paper on the investigation of the Orbits of Revolving Double Stars, inserted in the fifth volume of the memoirs of the Royal Astronomical So-

ciety; the other to Professor Decandolle, for his investigations in Vegetable Physiology, as detailed in his work entitled Physiologie Vegetale.

I have the honor to be, Sir, your most obedient servant, Charles Cunig,
For. Sec. Roy. Soc.

To the Secretary of the American Philos. Soc., Philadel.

Description of the Vocal Organs.—[We are allowed to extract the following description of one of the most interesting parts of the human frame, from the Anatomical Class Book, by Dr. J. V. C. Smith,—the pioneer, we believe, of popular text-books on this subject.]

By voice, animals have the power of making themselves understood to their own species—and these sounds are either *articulate* or *inarticulate.*

Language is an acquired power, having its origin in the wants of more than one individual. Man, without society, would only utter a natural cry, which sound would express nothing but pain.

Supposing a human being to have been entirely forsaken by those of his species, in that state of infancy when he could have no recollection of any thing pertaining to his race, his voice would, in essence, remain the cry of an infant, only strengthened in tone, at a particular age, by the development of the vocal organs to their destined size.

But let two individuals be placed together, but without communication or knowledge of the existence of beings similar to themselves, the natural cry of each would undergo modifications: the one would make a sound, to express a particular sensation, which in time would be understood by the other: a repetition of the same note would be the sign of that sensation in future.

An additional sensation, having an intimate connection with the first, would require a variation of tone,—and this would also become a symbol of two sensations. Here then would be the origin of language. Multiply the species, and each new member of the society would express some other sensation or want, by another modification of the original cry. Here we discover the certain commencement of a spoken language; these different sounds becoming classified, constitute a dictionary, in which each word is the mark or sign of particular sounds; thus, if an individual can imitate the sound, or a series of sounds, he masters a language. Let it be remembered that man could never arrive to this perfection in sound or language, if his vocal organs were not differently constructed from brutes. Such is the mechanism of theirs, that so many sounds, and no more, can be made; but in man's organs, there is no limitation—no sound appreciable that he cannot imitate.

The Vocal Box, or Larynx.—Directly under the integuments on the front side of the neck, is a cartilaginous tube, the *trachea*, or wind-pipe, built up of a series of narrow strips, which are portions of a ring; therefore, it is always kept free and open. At its lower end it divides into two branches, going to the lungs on either side, but its upper portion is enlarged, just under the chin, and finally opens in common with the tnbe of the stomach and mouth. This enlarged part, quite prominent in man, is the *larynx* or vocal organ.

Several cartilages assist in its formation, viz., the *thyroid*, *cricoid*, the *arytænoid*, and the *epiglottis*. The cricoid is the foundation; the thyroid is the wall around it; the arytænoid are appendages to the back of the cricoid; and the epiglottis is a valve, opening and closing the entrance into the windpipe, like the valve of a bellows.

Fig. 1.

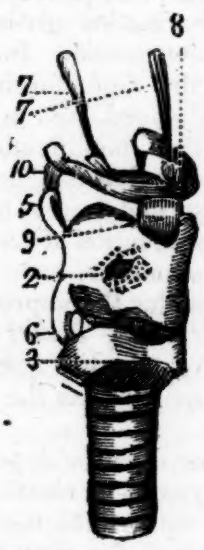


Fig. 2.

Explanation of figures 1, 2.—The five cartilages are—1, the epiglottis; 2, the thyroid cartilage; 3, the cricoid auxiliary; and 4, the two arytænoid cartilages; 5, the two superior horns of the thyroid cartilage; 6, the two inferior horns; 7, the suspensory ligament of the os hyoides; 8, the os hyoides; 9, the azygos ligament, connecting the os hyoides to the thyroid cartilage; 10, the two lateral ligaments connecting the horns of the os hyoides to the superior horns of the thyroid cartilage.

One of these diagrams presents a front and the other a back view of the *larynx* or vocal box. The bone of the tongue is seen,

like half of a hoop, marked 8, in both plans. 2 is the front of the *thyroid cartilage*, felt under the skin—protruding in the form of an irregular tumor. The wind-pipe is the tube at the bottom of each larynx. The *vocal cords*—the membranes which vibrate to produce sound, as the current of air rushes by—are concealed, being placed inside. From the remarks in the text, together with the references, a very correct idea will be formed of the structure of this curious organ. By blowing through the wind-pipe of almost any animal, soon after it is slain, provided the larynx has not been injured, the vocal cords may be put in motion, and the sound which is produced will bear considerable analogy to the natural voice of the animal.

Within the larynx, and consequently below the valve, are four delicate membranes, two on each side, put upon the stretch—being, in fact, like shelves—their thin edges nearly meeting from the opposite sides, so that there is scarcely any space between them. These are the vocal cords.

When the air rushes out from the lungs through the wind-pipe, it must obviously pass through the larynx,—in doing which it strikes the tense edges of the cords, and produces a vibration. This vibratory motion given to the current of air produces sound. In the cavities of the bones of the face, forehead and nose, its power is increased, and in the mouth it undergoes further modifications, and ultimately becomes articulate language. The teeth, tongue, lips, nose and fauces, have each an influence in the production of articulate sounds. Hence grammarians have arranged the human voice under the appropriate divisions of *guttural*, *nasal*, *dental* and *labial* sounds,—expressive of the agency which each of these organs exert on the original tone.

Shrillness or roughness of voice depends on the diameter of the larynx,—its elasticity, lubricity, and the force with which the expired air is propelled through the *rima glottidis*, or slit-like chink, between the vocal cords.

It is because the larynx is smaller in women, and more elastic, that their voice is of a different character. The breaking of the voice, (*vox rauca*,) noticeable in boys, at a peculiar age, depends partly on the enlargement of the apartments within the bones, which generally takes place at that important crisis of their lives, when the whole constitution undergoes a sudden change.

But the mechanism of voice would have been incomplete, were there not a number of exceedingly delicate muscles, which graduate the diameter of the narrow slit through which the sound escapes into the mouth. Unconsciously, they effect the requisite contractions, forever varying, according to the rapidity, intensity, or strength of the voice, in singing, conversation, or declamation.

Finally, the larynx is a musical wind instrument, of the *reeded* kind, on the principle of the hautboy. The nearness of the vocal cords to each other resembles the reed precisely. All the tones of reeded instruments are effected by finger holes,—but the tones of the human voice are varied by the extrinsic and intrinsic muscles, which shorten or elongate the vocal tube. Thus the same result is produced by this process,—increasing or diminishing the diameter of the larynx, that is accomplished in the clarionet, bassoon, flute and hautboy, by a graduated scale of finger holes.

Is not this another beautiful mechanical evidence of the existence of a Being superior to ourselves!

LEAD IN THE UNITED STATES.—The quantity of lead made at the U. S. Lead Mines during the year ending 30th September, 1833, was 7,941,792 lbs., of which goes to the United States, as rent, 472,645 lbs. Annexed is the statement of the quantity made at these mines since 1821:

From 1821 to Sept. 30,	1823,	535,130 lbs.
Year ending Sept. 30,	1824,	175,220 do.
" "	1825,	1,051,220 do.
" "	1826,	2,333,804 do.
" "	1827,	6,092,560 do.
" "	1828,	12,311,730 do.
" "	1829,	14,541,310 do.
" "	1830,	8,332,058 do.
" "	1831,	6,449,080 do.
" "	1832,	4,281,876 do.
" "	1833,	7,944,792 do.
Total,		63,845,740 lbs.

NOVEL SPECIES OF STREET PAVEMENT.—A gentleman lately from St. Petersburgh describes a new and ingenious mode of paving streets, successfully tried in that capital. Instead of wrought stones or Macadam's gravel (both of which are in use there) the Russians have employed blocks of wood, we presume hard wood, set on end. They are about a foot long, by eight or nine inches broad, and are cut into hexagons, which are closely joined and fitted to each other. When seen from a window in the second or third story, they present a regular and beautifully tesselated surface, like the inlaid oak floors seen in old houses. The droskies, which, from their heaviness and the smallness of their wheels, make an intolerable noise on the wrought stone pavement, pass over the blocks of wood as quietly as if they rolled on a carpet.—[Liverpool Albion.]

Statistics of the Globe.—The rapid population of the globe is estimated variously from 600,000,000 to 800,000,000; the geographical square miles at nearly 38,000,000, or 49,000,000 English square miles. The population to a square mile is, in France 61, Asia 27, Africa 10, America 3, Oceanica less than 1; the average of all about 17. The densest population in any whole province or state, is in Hamburg, where it is 1302 to a square mile. It is 980 in Bremen, 783 in Frankfort, 523 in Lubec, 464 in Lucca (Italy), 392 in Belgium, 314 in Saxony, 277 in Holland, 257 in Great Britain, the Sicilies 236, 208 in France, Austria 165, Prussia 155, Portugal 121, Denmark 119, Spain 101, Turkey 63, Greece 51, Russia 37.

In Asia some provinces have a population of from 200 to 500 to the square mile; Japan 139, China 42, Siam 57, English Indian Empire 185. In Africa, Morocco has 46, Tunis 45, and some of the interior kingdoms a little more. In America, Hayti has 36, Central America 12, Chili 10, United States 7½, Mexico 6.

The votaries ef the different regions are reckoned as follows by Pinkerton:—Christianity 235,000,000, Judaism 5,000,000, Mahometan 120,000,000, Bramanism 60,000,000, Buddhism 180,000,000, all others 100,000,000.—[New-England Farmer.]

Stump Machine.—The last and best stump machine I have seen or heard of consists in a *wheel and axle*. A large but simple frame is supported by two upright posts within the frame, and upon the uprights an axle is made to revolve by a wooden wheel of some ten or twelve feet circumference, with a strong chain passing around its periphery. Two yoke of oxen will turn the wheel, and thus another chain, fastened to the axle and to the stump under the machine, is wound around the axle until the stump is torn from the earth. The machine, though light, is somewhat unwieldy; but the difficulty of transporting it from one stump to another might be removed by affixing wheels to it, and this would in no wise interfere with the operations of the machine. It is difficult to say how many stumps might be pulled in a day in this manner, for such computation would be influenced by a variety of circumstances, such as the character and size of the stumps, the nature of the soil, &c., but many hundred acres of the New-England territory have been cleared by this machine, at the rate of $10 the acre; and in some instances large tracts of land, which were once thickly wooded, have been rendered stumpless for the small sum of eight dollars the acre, every stump, exceeding six inches in diameter, being removed.—[North. Courier.]

Economy in the Use of Steam. [Communicated for the American Railroad Journal, and Advocate of Internal Improvements.]

It has been for several years past, to the writer, an important object, and a favorite study, to effect, if possible, a saving in the use of steam; and after a great variety of experiments on the subject, he has arrived at the conclusion, and believes he can demonstrate clearly to every rational mind, by actual experiment, a saving of nearly one-half, by the use of double cylinder engines. In order to illustrate the fact, he has fitted up a small model, so arranged as to give every possible chance to test fairly the correctness of his theory. The machine above mentioned is constantly in operation at Wm. T. James' foundry and steam engine factory, No. 40 Eldridge street, where those interested in such matters are respectfully invited to call and satisfy themselves.

Specification of a Patent for a New Manufacture of Wheels for Locomotive Engines and Cars, to run upon Railroads, granted to Matthias W. Baldwin, *city of Philadelphia, June* 29, 1833. [From the Journal of the Franklin Institute.]

To all whom it may concern, be it known, that I, Matthias W. Baldwin, of the city of Philadelphia, have invented a new and useful manufacture of wheels for locomotive engines and cars, to run upon railroads, and that the following is a full and exact description of my said invention.

Instead of making the wheels for the carriages of locomotive engines, and of other cars, or carriages, to be used upon railroads, of cast iron, or of a combination of cast and wrought iron, or of wood combined with cast or wrought iron, or with both, as they have been heretofore made, I cast the rims of such wheels, as well as in most instances the spokes and hubs, or naves, in one piece with the rims, of a composition of metal known to workmen under the name of hardened brass, or gun metal. It is not necessary for me to designate the proportions in which the respective metals are mixed which form the hardened brass or gun metal, as these will vary with the degree of hardness desired in the rim, or tread, of the wheel, in a manner well known to those conversant with the casting of brass and its compounds. Where it is desirable to increase the adhesion between the rail and the wheel, it may be found necessary to make the wheel proportionably softer, by decreasing the quantity of tin entering into the composition of them, or even to cast them of soft brass or of copper entirely.

I do not intend to confine myself to any particular form for the tread of the wheel, or for the spokes and hub; but to modify it in such way as experience may suggest to be the best adapted to the particular carriage or road to which the wheel is to be applied. I intend sometimes also, to cast the rim of the wheel of such metal without spokes, but furnished with such flanches, lodgments, or projections, as shall enable me to attach thereto, spokes of wood, iron, or other material.

My claim to an exclusive privilege I rest entirely upon a new manufacture of such wheels, by substituting for their rims, or for every part of them, a new material as hereinbefore set forth, the utility of which consists in its being better adapted to the purposes which they are intended to answer in running upon railroads.

Matthias W. Baldwin.

On Saxton's Improved Method of Propelling Carriages. By A Reader. To the Editor of the Mechanics' Magazine, and Register of Inventions and Improvements.

In your Magazine, Vol. II, page 251, you furnished your readers with the specification of a patent obtained in England by Joseph Saxton, for an improved method of propelling carriages. On reading it, I was very much pleased with the result promised, and at the same time rather incredulous, doubting whether the inventor had not deceived himself. I could not see through the principle, but did not think that any argument against the truth. I find I was not singular, for it is stated that "Many able engineers had found a difficulty in comprehending the principle." So, thinking it highly curious, and to put an end to my doubts, I made a small model. It works to admiration, and is the delight of every one who has seen it. It is a beautiful mechanical toy, but I am persuaded can never be used advantageously on so great a scale as railroad transportation would require. I had no intention of troubling you—it is the first time I have done so; but the subject has acquired new interest in my view, by the announcement, in a London paper, of some steps taken towards introducing the principle into practice.

I send inclosed the communication referred to, and I am, sir, A Reader.

New-York, 3d Feb., 1834.

Experimental Railway.—A lecture was given, or rather a conversation was held, yesterday noon, at a temporary building and railway, situate in Park street, near the Gloucester gate, Regent's Park, on the "Economical, rapid, and safe travelling upon railways by means of Mr. Saxton's patent locomotive differential pulley; by which simple invention (the placard states) a horse, walking at the rate of two or three miles an hour, will be able to propel a carriage at the rate of thirty miles an hour."

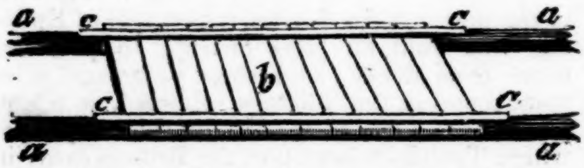
It appears that a few civil engineers and gentlemen being desirous of trying this invention, a piece of ground is formed into a railway of a quarter of a mile in extent, for the purpose of trying experiments, and yesterday the introductory lecture was given, and several models exhibited.

A Mr. Hawkins, who officiated, addressed the few gentlemen present, by observing that the railway was not in a sufficient state to try any experiments then, and he hoped no gentleman had come there under that impression; if so, his money should be returned. What he contemplated on the present occasion was to explain the principles on which Mr. Saxton's invention was founded, and to elucidate the same by models. This invention was calculated to propel a carriage at the rate of one mile in two minutes; the railway before them when completed would be a quarter of a mile in length, which distance and back, being half a mile, he anticipated performing in one minute. Ultimately he considered the distance from London to York might be performed in about six hours, and he did not despair of achieving in the same way a journey from the metropolis to Edinburgh in the space of one open day. The present invention was a new application of leverage, and one which was rather difficult to be understood, unless put in operation. Many able engineers had found a difficulty in comprehending the principle; but he would use his best endeavors to make himself clearly understood, and should feel happy in answering any question put to him. It consisted of having ropes, one mile in length, extending along the railway, and by means of Mr. Saxton's differential pulley, it was calculated that, with the power of one horse, a carriage, containing passengers to the weight of about one ton, could be propelled at the rate already stated of thirty miles an hour. It would require one horse to each mile, but whilst the carriage proceeded at the rate of thirty miles, the horse would only perform a distance of 150 yards; at the end of each mile fresh ropes were applied to the carriage, a fresh horse worked the second pulley, and thus it proceeded on the journey, a person being stationed at the end of each mile to effect the change of geerage. By these means, it was asserted, the greatest acclivity might be ascended, and the experimental railway would be so formed as to show its effect in this particular, part of it being on the same scale of declivity as Shooter's Hill, or one foot in ten. He next proceeded to show, by means of diagrams and models, the mode in which the propelling force was acquired by the newly invented pulley, and then proceeded to state that it was not his intention to run heavy carriages on the railway. One ton, he thought, would be quite sufficient, because, when they could send ton after ton at the rate of thirty miles an hour, and without any delay between, carrying great weights was unnecessary. On the present plan of locomotive engines, it was indispensible that they should be formed to carry heavy weights, because the locomotive engine generally weighed ten tons; and that great weight, being in a state of agitation, wore out and damaged the road infinitely more than all the traffic that passed over. It was found also that one locomotive engine required three times as much fuel as a stationary engine of the same power. It was his intention to use horses, because one-horse power would be sufficient for his purpose; and it was found that there was no saving in using engines under six-horse power, it being as cheap to keep six horses as to work a six-horse engine. There would, in this way, be a great saving in the expense of the power; there would also be a great saving in the construction of the railway. At present a yard of railway weighs 50 lbs.; his would weigh less than half. At present hills are cut down, and valleys raised, to make a railway; by the proposed plan this would be unnecessary.

Mr. Hawkins, having concluded his lecture, answered several inquiries made of him by gentlemen present, and received their best wishes for his success. In the course of the conversation, he mentioned that the manufacturer who had made the rails for the company was now executing an order from America for 1,000 miles of railway.

A New Plan for the Construction of the Wood Work of Railroads. By ELISHA JOHNSON. To the Editor of the American Railroad Journal, and Advocate of Internal Improvements.

SIR,—Having introduced a new plan for the construction of the wood work of railroads, which is adopted by the directors of the Buffalo and Black Rock Railroad Company, I wish, through your valuable Journal, to give a brief description of the same, in answer to inquiries that have been made.



Place longitudinal sills, *a a*, of round timber one foot in diameter, hewed on one side, even with the surface of the grade; cover the road bed with plank, *b*, two and one-half inches in thickness, and seven feet long, resting upon the grade and sills; over the sills place two by four inch scantling, *c c*, on which are placed the iron plates: all of which parts are secured by eight-inch spikes, terminating in the sills.

The plan is proposed for new districts of country, where the location of the line of road is through low table lands, or the rich farming lands of secondary formation, which are retentive of moisture, or light sand soils; all of which would require expensive preparations of the grade by rubble or gravel blind drains, &c., to prepare for the reception of the timber work.

In the usual form of timber constructions, it has a superficial bearing of twenty-nine feet upon the grade, to the rod. In the above form, there is one hundred fifteen and one-half feet of bearing per rod, increasing the strength of road in proportion to its bearing, on unprepared grades, and ample strength for locomotive power with heavy trains, on alluvial soils.

The expense of materials is about the same in either plan, where suitable timber for rails can be obtained in the vicinity of the line of road.

The improvement proposed consists in saving the expense of a prepared grade and horse path, varying in cost from one to two thousand dollars per mile; also, a saving of the item of suitable rails, when they have to be obtained at great expense of transportation, as well as the mechanical work connected with them.

The plan proposes other advantages, viz.: the admission of the use of such timber as is most convenient to obtain near the line of road; a material saving of expense in passing water-courses, bridges; and the construction of turnouts and crossings by a continuous floor, which forms a roof to the grade; when by use and the effect of rains, the joints of the timber are filled with earth, the water passing off through triangular apertures △, at the meeting at the ends of the supports to the iron; greater security from the effect of frost, by reason of the form of construction and a dry grade; the spike that secures the iron, secures the different parts of the timber work; a dry horse-path, which is proposed to be protected by the use of a thin coating of sand over the floor—this will protect the timber from the effects of the sun, and preserve a more uniform moisture, aiding the preservation of the timber.

In reference to objections that may be urged against proposed improvements, it is not practicable to answer them fully, except by the test of experiment. In the construction and use of such a form of road, it is suggested that it may be inconvenient to repair an imperfect embankment, which is remedied by the ease which the wood work may be taken up and put down again, or by having movable plank at every three or five feet, to be drawn out from between the spike or every other plank moveable, if screwed six inches in width.

The wear of the plank and the effect upon the horse at a speed of ten miles per hour, are proper questions of inquiry. In answer, the wear of the plank: by comparisons made without protection, as proposed, it is satisfactorily ascertained that the wear will be less than the decay for the amount of horse power required on railroads, if locomotive power is not used. The effect upon the horse is believed to be more favorable than upon a compact gravel road in dry weather or frozen earth, ice, or stony roads, if not relieved by the sand covering.

A question may arise, of comparative effect upon the decay of the timber. In the common form, parts of the work, such as the tenants of the cross timber or sleepers, are believed to be in the most exposed situation they can be placed; when in the proposed form, by a continuous bearing upon the grade, the timber can be used in an advanced state of decay.

The simple form of construction removes a prominent cause of expense in the details of the management of laborers and mechanics necessary in completing the several parts in the common form of construction: if connected with the contracts for grading, the sills are put into the grade as a part of the contract. Twelve days, with one superintendant, one mechanic, and six laborers, will complete a mile of road, with the materials delivered on the line, tested by experiments that have been made; the time required is the time necessary to drive the spike.

In adopting the aforesaid principle of transferring the strength of rail to the sill, and obtaining strength of grade by increasing the superficial feet of bearing, will admit of many variations from the above described form, in the

size, quality, and quantity of timber, in different descriptions of grade, and in the use of red cedar, with many other particulars not proposed to be entered upon in this communication.

The experiment that has been made in the completion of three-fourths of a mile on the Buffalo road, have been favorable in the results; and in the experiments of loaded cars on the track, a favorable effect was noticed by reason of the continued bearing and direct connection with the grade, particularly on a part of the grade that was loose clean sand, which, from its confined position, had the apparent effect of a stone foundation: the grade receiving all of the action of a moving heavy body.

If these remarks should contribute to useful inquiry, and an improvement made in the form of construction, adapted to the age and circumstances of our country, where capital bears a high rate of interest, and the present limited business of different sections not warranting expensive constructions, would be all that could be expected from these imperfect remarks.

ELISHA JOHNSON, Civil Engineer.

Rochester, Jan. 24, 1834.

COAL STEAM BOILERS.—The construction of steam boilers of such a form as to admit of the use of anthracite coal for fuel, instead of wood, has long been a desideratum. In the engine and apparatus of the steamboat Novelty, it was first designed to use coal, but from some imperfection or obstacle then yet unsurmounted, in the arrangement and adaptation of the furnace and boilers, that design was abandoned.

It is now understood that Dr. Nott has persevered in his experiments for the construction of a boiler and furnace, in which coal may be used to greater advantage than wood, till success has crowned his efforts. But what the form or fashion of his contrivance is for this purpose, we are not informed.

We see it stated in a New-York paper, that a Mr. Disbrow, already favorably known to the public as an ingenious and enterprising mechanic, has likewise succeeded in constructing a "*Lackawana coal boiler*," one of which is in operation on board the steamboat Delaware, and of which an individual who witnessed its operation says, "it accomplishes all the anticipations of the inventor."

CRUCIBLE FOR FUSION.—Make a hole in a Hessian crucible, holding two or three quarts; put inside of this crucible the cover of a smaller crucible, so that it may rest about three-fourths of the depth; make with a file several notches around this cover to admit the air fairly, having the knob of the cover uppermost. On this knob place a little crucible containing the metal, which must be covered; put some lighted charcoal around it, and then fill up with coke, so as to cover entirely the interior crucible. Connect this apparatus with a blacksmith's or other bellows, and keep up a constant blast, supplying the waste coke as it is consumed; in the course of 20 minutes the steel will be melted. Other minerals, even some that are reputed infusible, will yield in like manner. This simple and cheap apparatus abridges time and labor surprisingly, and effects what, with the common and costly furnaces, would be impossible.—[Jour. de. Con. Usuelles, tom. xv. p. 143.]

TIMBER, by the process of charring or burning the surface, may be preserved for an indefinite time, even though exposed to damp, or buried in the earth. The utility of charring timber used for posts or water works, is so evident, that we are surprised it is not more generally attended to. The most wonderful proof of the indestructibility of charcoal timber is given in Watson's Chemical Essays, where we are informed "that the beams of the theatre of Herculaneum were covered with charcoal, by the burning lava which overflowed that city; and during the lapse of 1,900 years, they have remained as entire as if they had been formed but yesterday." This property was well known to the ancients, as the famous temple of Ephesus was built on piles charred to preserve them from decay; and some years ago, piles were found in the Thames, charred, in a perfect state of preservation, in the very spot where Tacitus relates that the Britons drove in piles to prevent the attack of the fleet of Julius Cæsar.

SALT SPRINGS.—*Supply of Water in the Onondaga Salt Springs.*—The actual consumption of water annually cannot be less than 90 or 100,000,000 gallons, averaging 260,000 gallons per day, for 365 days, though the consumption during the summer months cannot be less than 7 or 800,000 gallons per day. —[Onondaga Standard.]

FOR DIPPING BLACK SILKS, WHEN THEY APPEAR RUSTY OR FADED.—Your discretion must be used whether the silk can be roused, or whether it requires to be re-dyed. Should it require re-dying, this is done as follows: for a gown, boil two ounces of log-wood; when boiled half an hour, put in your silk, and simmer it half an hour, then take it out and add a piece of blue vitriol as big as a pea, and a piece of green copperas as big as the half of a horse bean; when these are dissolved, cool down the copper with cool water, and put in your silk, and simmer half an hour, handling it over with a stick; wash and dry in the air, and finish as above. If only wanting to be roused, pass it through spring water, in which is half a tea spoonful of oil of vitriol. Handle in this five minutes, then rinse in cold water and finish as above.

FOR DYING GREEN.—Take blue and oil of vitriol, mix them together; then take fustic, boil it till it is a good color, then put in your vitriol until it is the shade of green you want; wet your silk all over with warm water first, put your dye on, and hang it in the sun, then brush it off as before.

The Unbeliever.—I pity the unbeliever—one who can gaze upon the grandeur, and glory, and beauty, of the natural universe, and behold not the touches of His finger, who is over, and with, and above all; from my very heart I do commiserate his condition.

The unbeliever! one whose intellect the light of revelation never penetrated; who can gaze upon the sun, and moon, and stars, and upon the unfading and imperishable sky, spread out so magnificently above him, and say all this is the work of chance. The heart of such a being is a drear and cheerless void. In him, mind—the god-like gift of intellect, is debased, destroyed; all is dark—a fearful chaotic labyrinth—rayless—cheerless—hopeless!

No gleam of light from heaven penetrates the blackness of the horrible delusion; no voice from the Eternal bids the desponding heart rejoice. No fancied tones from the harps of seraphim arouse the dull spirit from its lethargy, or allay the consuming fever of the brain. The wreck of mind is utterly remediless; reason is prostrate; and passion, prejudice, and superstition, have reared their temple on the ruins of his intellect.

I pity the unbeliever. What to him is the revelation from on high, but a sealed book? He sees nothing above, or around, or beneath him, that evinces the existence of a God; and he denies—yea, while standing on the footstool of Omnipotence, and gazing upon the dazzling throne of Jehovah, he shuts his intellect to the light of reason, and denies there is a God.—[Chalmers.]

The Chasseur Ants of Trinidad.—One morning my attention was arrested at Laurel Hill by an unusual number of black birds, whose appearance was foreign to me; they were smaller but not unlike an English crow, and were perched on a calibash tree near the kitchen. I asked the house negress, who at that moment came up from the garden, what could be the cause of the appearance of those black birds? She said, "Misses, dem a sign of the blessing of God; dey are not the blessing, but only de sign, as we say, of God's blessing. Misses, you will see afore noon-time how the ants will come and clear the houses." At this moment I was called to breakfast, and thinking it was some superstitious idea of hers, I paid no further attention to it.

In about two hours after this, I observed an uncommon number of *chasseur ants* crawling about the floor of the room: my children were annoyed by them, and seated themselves on a table, where their legs did not communicate with the floor. The ants did not crawl upon my person, but I was now surrounded by them. Shortly after this the walls of the room became covered by them; and next they began to take possession of the tables and chairs. I now thought it necessary to take refuge in an adjoining room, separated only by a few ascending steps from the one we occupied, and this was not accomplished without great care and generalship, for had we trodden upon one, we should have been summarily punished. There were several ants on the steps of the stair, but they were not nearly so numerous as in the room we had left; but the upper room presented a singular spectacle, for not only were the floor and the walls covered like the other room, but the roof was covered also.

The open rafters of a West India house at all times afford shelter to a numerous tribe of insects, more particularly the cockroach, but now their destruction was inevitable. The chasseur ants, as if trained for battle, ascended in regular thick files, to the rafters, and threw down the cockroaches to their comrades on the floor, who as regularly marched off with the dead bodies of cockroaches, dragging them away by their united efforts with amazing rapidity. Either the cockroaches were stung to death on the rafters, or else the fall killed them. The ants never stopped to devour their prey, but conveyed it to their storehouses.

The windward windows of the room were of glass, and a battle now ensued between the ants and the *jack-spaniards* on the panes of glass. The jack-spaniards may be called the wasp of the West Indies; it is twice as large as the British wasp, and its sting is in proportion more painful. It builds its nest in trees and old houses, and sometimes in the rafters of a room. These jack-spaniards were not quite such easy prey as the cockroaches had been, for they used their wings, which not one cockroach had attempted to do. Two jack-spaniards, hotly pursued on the window, alighted on the dress of one of my children. I entreated her to sit still, and remain quiet. In an inconceivably short space of time, a party of ants crawled upon her frock, surrounded and covered the two jack-spaniards, and crawled down again to the floor, dragging off their prey, and doing the child no harm. From this room we went to the adjoining bedchamber and dressing-room, and found them equally in possession of the chasseurs. I opened a large military chest full of linens, which had been much infested; for I was determined to take every advantage of such able hunters. I found the ants already in possession of the inside; I suppose they must have got in at some opening at the hinges. I pulled out the linens on the floor, and with them hundreds of cockroaches, not one of which escaped.

We now left the house and went to the chambers built at a little distance, but these were also in the same state. I next proceeded to open a store-room at the end of the other house for a place of retreat, but to get the key I had to return to the under room, where the battle was now more hot than ever. The ants had commenced an attack on the *rats* and *mice*, which, strange as it may appear, were no match for their apparently insignificant foes. They surrounded them as they had the insect tribe, covered them over, and dragged them off with a celerity and union of strength that no one who has not watched such a scene can comprehend. I did not see one rat or mouse escape; and I am sure I saw a score carried off during a very short period. We next tried the kitchen, for the store-room and boys' pantry

were already occupied, but the kitchen was equally the scene of battle between rats, mice, and cockroaches, and ants killing them. A huckster negro came up selling cakes, and seeing the uproar, and the family and servants standing out in the sun, he said, "Oh, Misses, you've got the blessing of God to-day, and a great blessing it is to get such a cleaning."

I think it was about ten when I first observed the ants; about twelve the battle was formidable; soon after one the great strife began between the rats and the mice; and in about three the houses were cleared. In a quarter of an hour more the ants began to decamp, and soon not one was to be seen within doors. But the grass around the house was full of them; and they seemed now feeding on the remnants of their prey, which had been left on the road to their nests; and so the feasting continued till about four o'clock, when the black birds, who had never been long absent from the *calibash* and *pois doux* trees in the neighborhood, darted down among them, and destroyed by millions those who were too sluggish to make good their retreat. By five o'clock the whole was over: before sundown, the negro houses were all cleared in the same way; and they told me that they had seen the black birds hovering about the almond trees close to the negro houses as early as seven in the morning. I never saw the black birds before or since, and the negroes assured me that they were never seen but at such times.—[Mrs. Carmichael on the West Indies.]

Compression of Water.—Mr. Jacob Perkins has invented an apparatus, which, by hydrostatic pressure, compresses water to an extent equal to a fourteenth part of its volume. The force employed is equivalent to a pressure of 30,000 lbs. to the square inch, and is applicable to other fluids. In most of our works on natural philosophy, water is treated as incompressible and non-elastic; by this apparatus the opposite of these two propositions is clearly shown. There was a considerable difficulty in getting a vessel capable of resisting so high a pressure; and the chief feature of this instrument is the manner of constructing the cylinder, which is formed of a series of concentric tubes: thus the inner or smaller tube is first formed by welding, and is turned accurately on the outer surface; the next tube is then formed, and is accurately turned on the inner surface, and the bore of this second or outer tube is just too small to receive the first tube, but, in order that it may do so, it is heated, till, by expansion, it is capable of receiving the first tube within it, and in cooling, the second tube shrinks on the first tube and strongly embraces them together; a third tube, a fourth, and so on, are similarly put on, till a cylinder is produced capable of withstanding any pressure.—[Repertory of Patent Inventions.]

Popular Errors in Medicine—[By an Edinburgh Physician.]—A very common practice in eating such fruit as cherries is to swallow the stones, with the vague notion that these promote digestion. No error can be more fatally absurd. Many cases have occurred where such practices have been the cause of death, and that of a very excruciating nature. One instance is on record of a lady who died in great agony after years of suffering, and the cause was found to be several large balls lodged in the intestines, accumulated around clusters of cherry stones. The husks of gooseberries are often swallowed with the idea that they prevent any bad effects from the fruit. On the contrary, they are the most indigestible substance that can be swallowed, and pass the stomach without any change, although they cause excessive irritation, and not unfrequently inflammation in the bowels.

Many people put great faith in the wholesomeness of eating only of one dish at dinner. They suppose that the mixture of substances prevents easy digestion. They would not eat fish and flesh, fowl and beef, animal food and vegetable. This seems a plausible notion, but daily practice shows its utter absurdity. What dinner sits easier on the stomach than a slice of roast or boiled mutton, and carrots or turnips, and the indispensable potato? What man ever felt the worse of a cut of cod or turbot followed by a beef-steak, or a slice of roast beef and pudding? In short, a variety of wholesome food does not seem incompatible at meals, *if one do not eat too much*—here the error lies.

It is a practice with bathers, after having walked on a hot day to the sea-side, to sit on the cold rocks till they cool before going into the water. This is quite erroneous. Never go into the water if over-fatigued, and after profuse and long-continued perspiration, but always prefer plunging in while warm, strong and vigorous, and even with the first drops of perspiration on your brow. There is no fear of sudden transitions from heat to cold being fatal. Many nations run from the hot bath and plunge naked into the snow. What is to be feared is sudden cold after exhaustion of the body, and while the animal powers are not sufficient to produce a reaction or recovery of the animal heat.

There is a favorite fancy of rendering infants and farther advanced children hardy and strong by plunging them into cold water. This will certainly not prevent strong infants from growing stronger, but it will, and often does, kill three children out of every five. Infants always thrive best with moderate warmth and a milk-warm bath. The same rule applies to the clothing of infants and children. No child should have so slight clothing as to make it feel the effects of cold—warm materials, loose and wide-made clothing, and exercise, are all indispensable for the health of little ones. But above all things, their heads should be kept cool, and generally uncovered.

Many people so laud early rising as would lead one to suppose that sleep was one of those lazy, sluggish, and bad practices, that the sooner the custom was abolished the better. Sleep is as necessary to man as food, and as some do with one-third of the food that others absolutely require, so five hours' sleep is amply sufficient

for one, while another requires seven or eight hours. Some men cannot by any possibility sleep more than four or five hours in the twenty-four; and, therefore, true to the inherent selfishness of human nature, they abuse all who sleep longer. No man should be taunted for sleeping eight hours if he can.

Many people do not eat salt with their food, and the fair sex have a notion that this substance darkens the complexion. Salt seems essential for the health of every human being, more especially in moist climates such as ours. Without salt, the body becomes infected with intestinal worms. The case of a lady is mentioned in a medical journal, who had a natural antipathy to salt, and never used it with her food; the consequence was, she became dreadfully infected with these animals. A punishment existed in Holland, by which criminals were denied the use of salt; the same consequence followed with these wretched beings. We rather think a prejudice exists with some, of giving little or no salt to children. No practice can be more ridiculous.

Indian Mode of Education.—Whatever the child learns, he learns for the most part from observation of his elders and his comrades. He soon finds *pride* is the spur of his exertions. He soon finds that success as a hunter will make him respected by his tribe, while awkwardness subjects him to intolerable ridicule. He listens to every thing that is said of hunting and trapping at home, and eagerly goes abroad with the view of earning some praise for himself. Thus it takes him but a few years to acquire a considerable degree of experience; and his reputation always corresponds to his merit. The same feeling just mentioned is appealed to with equal success in regard to most other branches of an Indian education. It is true, to a great extent, of numerous tribes, as Heckewelder observes respecting the Delawares, that a father need only to say in the presence of his children, 'I want such a thing done; I want one of my children to go upon such an errand; let me see who is the *good* child that will do it?" This word *good* operates, as it were, by magic, and the children immediately vie with each other to comply with the wishes of their parent. If a father sees an old decrepit man or woman pass by, led along by a child, he will draw the attention of his own children to the object, by saying, 'What a *good* child that must be, which pays such attention to the aged! That child, indeed, looks forward to the time when he himself will be old!' or he will say, 'May the great spirit, who looks upon him, grant this *good* child a long life!' In this manner of bringing up children, the parents, says Heckewelder, are seconded by the whole community. If a child is sent from his father's dwelling to carry a dish of victuals to an aged person, all in the house will join in calling him a *good* child. They will ask whose child he is, and, on being told, will exclaim, 'What! has the *Tortoise* or the *Little Bear* (as the father's name may be) so excellent a child?' If a child is seen passing through the streets, leading an old decrepit person, the villagers will, in his hearing, and to encourage all other children who may be present to take example from him, call on one another to look and see what a *good* child that must be. And so, in most instances, this method is resorted to for the purpose of instructing children in things that are good, proper, or honorable in themselves; while, on the other hand, when a child has committed a *bad* act, the parent will say to him, 'Oh! how grieved I am that my child has done this *bad* act! I hope he will never do so again.' This is generally effectual, particularly if said in the presence of others. The whole of the Indian plan of education tends to elevate rather than depress the mind, and by that means to make determined hunters and fearless warriors.—[Indian Traits.]

The Jackson Cotton Gin.—Mr. James Lynch, an ingenious mechanic of this place, has invented a new kind of Cotton Gin, to which he has given the above title. We should suppose from the name that it was intended to operate with a *powerful impulse.*

We have seen a model of the gin; but owing to the fact that we are not much acquainted with machinery of the kind, we are unable to speak with certainty of its advantages. It differs from the common gin in these respects: it contains three separate sets of cylindrical pickers, which are shorter and smaller than the common saw cylinder—and the teeth are finer. The arrangement of these pickers is one above another, the largest set being below, and presenting a front a little convex. The breast or ribs are of a peculiar form, not easily described, and wrought or cast of one piece of sheet metal. The seed cotton rolls in the hopper as in other gins, and is taken from all the pickers and thrown out at the flue, by one cylindrical brush. All the cylinders turn upon points, and are driven by two belts, passing over a drum in the rear of the machine.

The advantages of this gin are supposed to consist in its despatch; its requiring less power; occupying less space; being less apt to cut or injure the staple; picking cleaner; being less liable to take fire from friction; and from its being less liable to

choke and get out of repair, than those now in use.

Mr. Lynch intends going to Pittsburg shortly, with a view of procuring castings for this and other machinery. We wish him much success in the laudable enterprize.

Jenning's Patent and Premium Combined House Warmer and Cooking Apparatus. [Communicated by the Inventor.]

References.—1 1, Hot air registers. 2 2, Taps for the admission of cold water to supply the boilers, and for other purposes. 3 3, Tubes for conveying the steam from the side boilers, 6 6, into the hot air chambers, to restore as much moisture to the rarified air as the heated furnace may have deprived it of. 4, Hot closet. 5, An aperture to allow the surplus steam of the boilers to escape into the smoke flue. 6 6, Two side boilers providing a large and constant supply of hot water for family use. 7, Bake oven, always hot. 8, Furnace inclosed in brick work. 9, Ash pit. 10 10, Taps to draw off hot water from the side boilers. 11, Fire Register.

N. B.—The sash lights are used when the apparatus is not set in a recess to confine the steam, smell, &c. of the cooking, which pass off into the smoke flue.

This highly approved invention, for health, economy, and comfort, is allowed to be superior to any thing hitherto known, being adapted for, and capable of application to, every description of private as well as public buildings, (old or new,) so that with but one fire of anthracite coal, at less expense and labor than a usual kitchen fire, it will effect every thing required for cooking and laundry purposes, and also warm every apartment in the house to any agreeable temperature, with pure atmospheric air.

The fire not being allowed to go out during the winter season, an even, agreeable temperature is constantly kept up in the rooms, halls, passages, &c. It being entirely free from smoke, dust, gas, &c. one half of the usual domestic labor is saved. Cost, from 60 to $150.

This apparatus may be made to possess also the advantages of cooling the air of the apartments in summer, to about an arithmetical mean between the temperature of the air and the earth, by means of an extended cold air flue. The whole apparatus may be removed from one building to another at a trifling expense.

We have much pleasure in inserting the following testimonials of its worth:

"So important an improvement do we consider this method of warming apartments, that we trust the time is not far distant when no building of any size will be erected without the necessary means for putting it into execution.

"Rumford declares that, notwithstanding his first prejudices against stove heat, he found, from an experience of twelve years' residence in Germany, not only that warm rooms were more comfortable in winter, but also certainly tended to the preservation of health."—[Journal of Health.]

"Talk of the comforts of an English fire, indeed! There is not a nation upon earth, between this latitude and the pole, but knows more of the comforts of a fire than England does. The party seeking is placed at the wrong end of the apparatus, like that of a person obtaining flour or meal, who should expect to receive it at the hopper, before it has passed the millstones: he is situated at the source of supply, and not of the produce; the raw material is rushing from him, instead of his receiving that which has undergone the beneficial process."—[Gray's Operative Chemist.]

We, the undersigned, having used Joseph Jennings' Cooking Apparatus, combined with a Hot Air Furnace, in our dwelling houses, during the whole of the past winter, do cer-

tify, that we consider it the most economical, healthy, agreeable, and convenient method ever invented.

THOMAS STOKES, 53 Sixth street.
GEO. L. SPENCER, 38 do.
JOHN BROWN, 40 do.
B. PALMER, 145 Reed street.

To MR. JENNINGS, 42 Sixth street:

I have used your Cooking Furnace and Hot Air Apparatus for five months. I think, for health, comfort, cleanliness, and economy, there is nothing like it in this country, or any other. ABM. T. HUNTER, M. D.
17 Hudson street.
New-York, Feb. 22, 1832.

I have had one of your furnaces in use for the last winter, and am very much pleased with it; I have seen nearly all of the different patterns of furnaces used in the city, and I am sure that there is none to equal it for heat and economy. H. W. TITUS,
Builder, 113 Greenwich street.
New-York, September 6, 1832.

During the winter we have fearlessly kept up as hot a fire during the night as by day; and I can see no possible danger from fire when the apparatus is constructed upon your plan. As regards its influence upon health, our experience thus far proves it decidedly beneficial. Respectfully, yours,
HUDSON KINSLEY, M. D.
New-York, April 18, 1833.

A PROPOSAL.—American children, by contributing one cent a week each, for ten years, might procure two hundred millions of testaments .If each of these were read by four persons, every member of the human family might hear of the *glorious freedom* of the gospel. And would not such a blessing, conferred upon the world by the children of our nation, be a blessing to them? Is such a blessing for our nation and the world impracticable? Is there one of the four millions of American children who cannot procure one cent to give on every Monday morning for some object of *Christian benevolence*? Is there one parent in the nation who would refuse to a child the blessing of giving? Where then is the difficulty? Why not commence at once upon a measure so easy; upon an object so great, and christian, and glorious? Why would it not be wise for each of the 50,000 teachers in the nation to propose to their pupils to contribute on next Monday morning one cent each for some object of common benefit to their school, or of good to another school, or another State, or nation, or continent? Since the practice of *systematic benevolence* for schools and families is so simple, so easy, so great, and so christian, who is not ready to BEGIN?

MANKIND MUTUALLY DEPENDANT.

Not only the correct and excellent sentiments, and the accomplished expression of the following communication, but the source from which it emanated, give it a value for our paper. It is one among numerous compositions furnished by the Ladies' Composition Class of the Boston Wesleyan Lyceum. This piece, like many others which have been prepared by this class, does credit to the intellect and still more to the heart of the author. The sentiment and spirit manifested are those of christian kindness; and if believed and practised by the whole human family, would light up our depraved and forlorn world with the brightness of pure felicity. Who is not ready to try the experiment?

The cold-hearted stoic may boastingly accede to the sentiment, that 'man is sufficient for himself;' but the philanthropist rejoices in the beautiful system of mutual dependance which unites him so closely with the whole human family. He views with pleasure the facilities which the genius of men has supplied for communication with other lands; for contributing to the necessities, convenience and ease of each other, by exchanging the products of different climes; he considers all men as the children of one Parent, improving the advantages with which they are favored, for the benefit of themselves and of their brethren.

Not only do these pleasurable feelings arise in the breast of him whose heart is deeply imbued with love for the whole human race, but a little reflection will excite them in the mind of one whose views are more selfish and contracted; and constrain him to acknowledge the wisdom of a system for the division of labor, and for the promotion of friendly intercourse, which mankind, as it were by mutual consent, have so universally adopted.

Every vocation in life depends on many others for its support. The agriculturists of New-England, said to be the most independent class of people, may be adduced as examples in favor of this assertion; the toils of the blacksmith, the carpenter, &c. are all put in requisition to enable them to cultivate the soil to advantage.

The rich are dependant on the poorer classes, and the poorer classes on the wealthy: without the former, commerce and manufactures would languish—and deprived of the latter, the fatigues of manual labor would be added to those mental vexations from which the affluent are seldom exempt.

The young look to their superiors in years for counsel and instruction, and the aged to the vigor of youth and manhood for support.

A mutual dependance exists between the inhabitants of one clime and those of another; the wealth of one nation is comprised in its mines of silver and gold, that of another in the products of its soil. Those who depend on the latter may be considered as

peculiarly favored; for where the former exist, those arts which constitute the happiness and prosperity of a people are almost invariably neglected. From this circumstance, indolent habits, both of body and mind, are induced, and these in their turn generate many vices.

To the conquests of the Spanish in America, may be attributed the low state of morals, literature, and science, which prevails among them; for finding that they had acquired, with an extensive territory, a resource for the supply of all their wants, the natural advantages of their natal land were disregarded.

The advantages occurring from this system of mutual dependance are many; the division of labor, or the devotion of every man's talent to some particular trade or profession, is an economy, not only of time, but of health and of money.

Should one man engage in the pursuits which are now apportioned among many, much time would be lost in the acquisition of knowledge in various branches; his health would be impaired from the attention bestowed on them; his gain would not be in ratio to the expenses incurred; and no opportunity would be afforded of attaining to perfection in any.

From the consideration that we are continually reciprocating favors with our fellow beings, and that there are none so humble as not to be able to render us assistance in one way or another, we should be excited to kindness and humility; under the influence of so beneficent a system, the asperities of life should lose their keenness, and all the social feelings of our nature be expanded. M. O.

FRIENDSHIP.—"When fortune smiles, and life is prosperous and fair, then it is that the nominal and true friend may seem alike sincere." Then it is that small and great, rich and poor, bond and free, bow at your shrine and prostrate themselves as it were at your feet. But when unfortunately the dark clouds of sorrow and disappointment gather thick around you, and you find yourself beset with troubles, losses, crosses, and disappointments, on every side, then you are ready to exclaim, "Fortune can create friends, but adversity alone can try them." Your friends of fortune will desert you. They will laugh at your misfortunes, and heap upon you shame and disgrace. They will sink you, if possible, lower, in point of honor and reputation, and in all your attempts to rise, cross and blight you at every turn.

But not so with the true friend. Though all your earthly prospects are cut off, he will not desert you, but if possible administer to your relief. Let us, therefore, cultivate and cherish that friendship, and that alone which will not diminish, though sorrows oppress and afflictions invade us: that too which will cheer and animate us amid our darkest hours and shine brightest in affliction's night.—[Monthly Repository.]

Synopsis of Meteorological Tables, kept at Rochester, N. Y., for the years 1831, 1832, and 1833.

MONTHS.	TEMPERATURE.			PRESSURE.			INCHES RAIN.			INCHES SNOW.			TEM. SP. WA'R.		
	1831	1832	1833	1831	1832	1833	1831	1832	1833	1831	1832	1833	1831	1832	1833
January...	23.	26.4	31.4	29.45	29.56	29.42	.3	.9	1.4	15	15	11	37	39	35
February	23.5	26.	26.	29.70	29.63	29.51	.5	.4	0.0	33	29	35	36	37	37
March.....	41.8	38.6	35.4	29.39	29.44	29.50	1.3	.8	.1	5	9	7	37	38	36
April......	47.5	47.4	52.5	29.38	29.48	29.54	3.8	1.5	1.8	2		1	42	41	41
May.......	59.7	57.2	62.	29.42	29.51	29.51	2.8	4.3	6.1	6			48	48	50
June	71.6	70.3	62.	29.53	29.50	29.42	3.4	1.2	2.6				52	50	52
July........	71.3	74.	70.9	29.49	29.50	29.51	5.4	4	3.8				58	54	54
August ...	71.	70.5	68.	29.61	29.60	29.49	1.2	2	2				60	56	56
Septembr.	60.9	62.8	63.5	29.50	29.54	29.54	2.4	1.7	1.5				57	56	55
October...	51.5	52.6	19.5	29.54	29.50	29.46	4.2	2.3	1.3				54	53	55
Novembr.	38.9	41.5	40.4	29.44	29.51	29.48	1.6	2.8	1	3	6	8	48	49	50
Decembr.	19.5	34.5	34.	29.49	29.47	29.56	0.0	2.4	1	13	13	14	40	44	42
Ann. Res.	48.3	50.1	49.6	29.49	29.52	29.49	26.9	24.3	22.6	77	72	75	47.4	47.1	46.9

Coldest and Warmest Days of 1831, '32, & '33.

YEARS.	COLD'ST DAY.	WARM'ST DAY.	MEAN OF EX.
1831.	Feb. 7, 4° below zero	June 3, 95° above ze.	49.5
1832.	Jan. 27, 6° below zero	June 25, 88° above ze.	47
1833.	Jan. 17, 4° above zero	July 21, 91° above ze.	43.5

[Genesee Farmer.]

New Era of Steam Power.—In the December of the past year, we inserted several descriptions of improvements and projects respecting the application of steam power, and promised to continue to insert all that came under our notice worthy of recording. In order that our readers may be possessed of all the information that can be collected on this subject, we have introduced in this number eight pages of additional matter, and shall endeavor to give drawings in our next illustrative of some of the plans of the projectors which are now described.

Blanchard's Allegany River Steamboat. To the Editor, &c. &c.

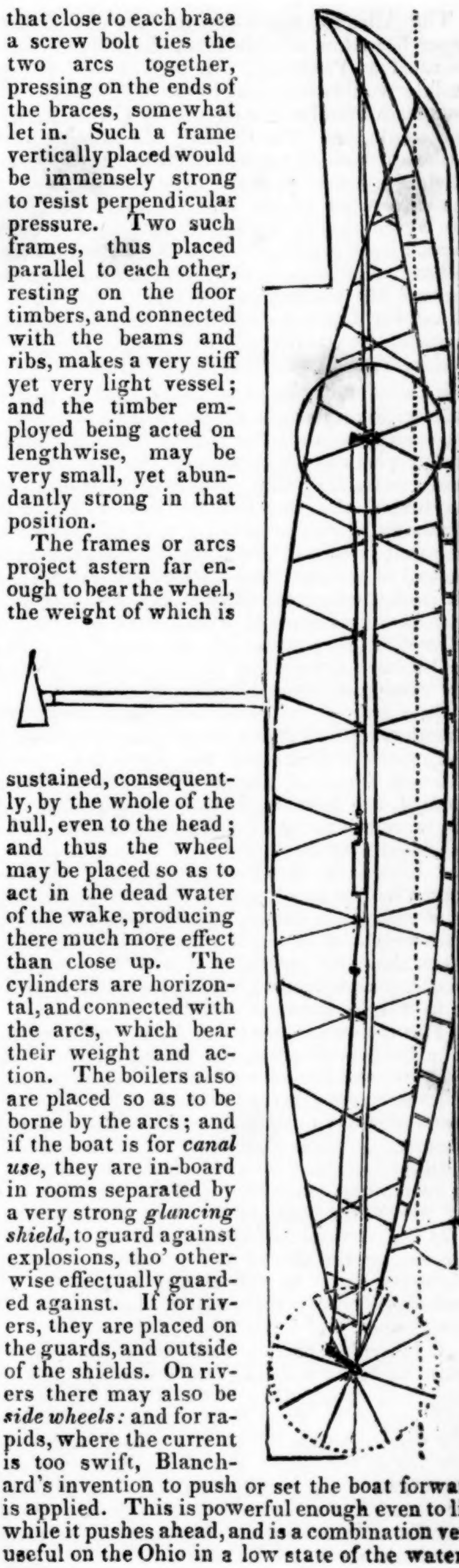
Sir,—If, in announcing the twin boat on Burden's plan, it could have been stated that it had run up rapids so heavy in descent that a canal had been actually made around them, where the fall is in fact eight feet a mile, it would have been admitted that "a New Era" in steam navigation had indeed commenced; and this is but a correct description of the performance of *Blanchard's boat* on the Connecticut, between Hartford and Springfield, passing up Enfield falls, daily, the summer past.

This sort of steamboat is the same that has made a passage up to Olean Point *from Pittsburg*. Others have since been built for constant business elsewhere: the Allegany route not yet being reached from New-York by the westward bound freight.

But I am led at this time to bring it into recollection and notice, as an *interested party*, from seeing, in one of your last numbers, mention of an improvement by Mr. Langdon, of Troy, in which some reliance appears to be placed on the principle of strength combined in Blanchard's patent.

The peculiarity of Blanchard's boat, which assures to it great speed, is the combination of means to construct a very light hull, having extraordinary vertical strength, so as to be able to carry a stern wheel, and *much more than usual power in proportion to size.* It may be said to combine ship carpentry and house carpentry with the principle of the arched bridge. This mode of construction, it will be seen by the annexed sketch, distributes the stress over the whole fabric. A great vertical force may bear on the arc frames; and if much longitudinal impulse is received, it is at their extremities. Even the cylinders of the engine are borne by these *arc frames;* and the *action and reaction* of the power is *all included within them.* The shell of the hull buoys up or carries the machinery, without being relied on to bear any strain.

Suppose two arcs of a circle of which the cord is rather longer than the length of the boat. Suppose them vertical and opposed, united at the extremities, and the curve preserved by braces in the form of an X; and that close to each brace a screw bolt ties the two arcs together, pressing on the ends of the braces, somewhat let in. Such a frame vertically placed would be immensely strong to resist perpendicular pressure. Two such frames, thus placed parallel to each other, resting on the floor timbers, and connected with the beams and ribs, makes a very stiff yet very light vessel; and the timber employed being acted on lengthwise, may be very small, yet abundantly strong in that position.



The frames or arcs project astern far enough to bear the wheel, the weight of which is sustained, consequently, by the whole of the hull, even to the head; and thus the wheel may be placed so as to act in the dead water of the wake, producing there much more effect than close up. The cylinders are horizontal, and connected with the arcs, which bear their weight and action. The boilers also are placed so as to be borne by the arcs; and if the boat is for *canal use*, they are in-board in rooms separated by a very strong *glancing shield,* to guard against explosions, tho' otherwise effectually guarded against. If for rivers, they are placed on the guards, and outside of the shields. On rivers there may also be *side wheels:* and for rapids, where the current is too swift, Blanchard's invention to push or set the boat forward is applied. This is powerful enough even to lift while it pushes ahead, and is a combination very useful on the Ohio in a low state of the water.

The Allegany boats can use the coal of the upper branches of this river, as well as that obtained at Pittsburg. A branch railroad to Buffalo would carry coal to the lake boats. A twin boat would not be so safe for the Allegany as a single one. The liability of a twin boat to strike aground, or against another vessel or obstacle, suddenly with *one* of the hulls, causes the *momentum of the other* (a force equal to the weight thereof multiplied into its velocity) to rend itself separate. And two hulls that are so heavy as to sink, if filled, doubles the danger, because the sinking of one upsets the whole. Whatever depresses one more than the other, disturbs the steering; but a single hull may heel without diminishing the power of the helm.

It seems reasonable to think that a single hull, with very ample power, will be the swiftest vessel, because she may receive the form and proportions nearly which Nature gives to quick swimming fish. Naval architecture has taken this hint, and follows it out as far as is consistent with the stability of sailing vessels. One that is shaped the same at both ends cannot sail as well as when gradually diminishing aft from the forward *third*. Since the resistance to the velocity is well known to increase in much higher ratio than the speed, the lighter the draft the greater promise of rapidity, as flat vessels sail fastest before the wind.

On a large scale, Blanchard's boat may have uncommon breadth and adaptation to the Ohio; and on the Hudson she may have both stern and side wheels. The more breadth of paddle applied, the less depth will be required, and the more advantageous the application. The cylinders may be upright for the side wheels, and horizontal for the stern wheel; all sustained by the arcs: and by thus distributing or dividing the power, more may be employed. The weight of an engine increases in a greater ratio than the power, therefore three engines would comprehend a greater proportion of power to weight, than one or two.

The resistance sustained by a body moving in a fluid is proportioned to the square of its velocity, and the area of its section immersed. Whatever the shape of the vessel, her displacement of water must be a quantity equal to her weight. In point of draft, or section immersed, nothing is gained by a twin boat; but in point of resistance, something is lost. In his work on the Steam Engine, Mr. Renwick observes that "an obvious advantage will be gained by increasing the size of the vessels, for the resistances vary as the *square* of similar dimensions, while the *tonnage* increases with their cubes."

It is evident that a boat upon Blanchard's plan, as broad and long as Burden's, and 32 feet wide, would draw but half as much water, and present no more cross section; and while the resistance would be the same, minus the friction of two sides, she would have the advantages of not parting the water at so much depth, and of avoiding by her shape the retarding force following or occurring at the stern. Burden's are 8 feet diameter.

For these reasons mainly, which are in their nature indisputable, I am led to think that Blanchard's kind of boat with stern and side wheels must be very favorable to the effect of the power, since with that of the stern wheel only, they perform so well.

Humble as may be the instrument described in this article, it can hardly be doubted from experience thus far, that it really commences a "*new era*" in the art, when steamboats will conquer the difficulties of rapid rivers, and combining the means of safety, traverse the great arc of the Union, from the head of the Allegany to the head of the Tennessee.

J. L. Sullivan.

Capt. Davis Embree, of Cincinnati, Ohio, has furnished us with the following description of an improvement in low water boats, that he is about to put in operation on the Ohio. He says he can lessen the draught of water at least *one-fourth*, while he retains the usual strength, speed, and convenience for freight and passengers. He says he will at the same time introduce the principle of the *life-boat*, and render it almost impossible to sink the boat by snags, rocks or waves.

The boat he is about to build will be 135 feet in length, and 24 feet wide; the hull will be 3 feet 3 inches deep. The beam of the boat will be shaped like the bowl of a table spoon, so as to rise over the water. Twenty-six feet from the stern there will be a recess on each side, of 6 feet, for the wheels to work in. The boat will be reduced there to 12 feet wide. Aft of the wheels there will be a clean run, and transom stern. This narrow part is intended to bear up the wheels and other machinery, and to furnish room for a stern castle, with its capstan, anchors, and other rigging, so essential on that part of the boat, as well as on the bow, when a boat is run in low water. By this arrangement, the wheels of the boat can be thrown out of gear, as well as other side wheels; they have all the advantage of working in eddy water, or a counter current, of the stern wheels. They have not the propensity to *break down* the stern of the boat, which is always attendant on wheels placed *behind* a boat. That part of the hull, which would otherwise be weak, in consequence of the recesses, will be supported by the cylinder timbers, and the bulk-heads under them.

The hull of the boat will in the first place have three main bulk-heads, running nearly its whole length, which will divide it into four parts: these bulk-heads will be made of $1\frac{1}{4}$ inch pine; they will be notched over the floor timbers and be fastened to the bottom plank; they will extend to the deck: there will then be ten cross bulk-heads, made of inch pine, placed 9 feet apart, made also water-tight, which will make forty water-proof rooms, 6 feet wide, 9 feet long, and 3 feet 3 inches deep. There will be in each of these rooms two stanchions, placed 3 feet apart, and 3 feet from the bulk-heads, upon the floor timbers, and under the beams. Thus there will be a bearing at

every 3 feet in every direction throughout the boat, between the bottom and deck. Then, to secure it more firmly, there will be 160 tie-bolts passed through the bottom, along side of the bulk-heads, and through the deck. This arrangement will give such great strength, that the timbers may be small; they will be made of selected young white ash, as tough as whip stocks. The floor and upright timbers will be but 3½ inches square. The beams (except for the boilers and wheels) will be 2¼ inches thick and 4½ wide, bent over the main bulk-heads, and made to extend about 1 foot over the sides of the boat, to form a narrow guard. The bottom plank will be 2 inch oak; the side plank the same; the deck will be 1¼ pine; the timbers or scuppers, to drain the bilge water to the pump, will be made by grooves in the bottom plank, so as not to weaken the timbers. The floor or bottom of the boat will be nearly flat, the nuckle nearly square, the sides will flare but 4 inches outwards. There will be small hatches into each room of the hull, to go into it, to stop scuppers or leaks, when required, so that if a snag run through the boat in any direction, so as even to destroy ten of these rooms, there will be still thirty left to buoy up the boat. She cannot sink but by great negligence. This is perhaps the most important feature presented by the plan; but when, in addition to this, we have a boat of full strength and speed, and containing all the usual convenience for freight and passengers, improved from 25 to 30 per cent. in draught of water, we have all that could be reasonably looked for. The boat is supposed to draw but 15 or 16 inches of water with her wood and water aboard, and then it will take nearly six tons to sink her one inch.

The hull will not be suitable or convenient to carry engine, freight, or passengers, within its body. It will be a single buoyant mass, made of light and strong materials; it will be a mere *float*. The first or lower deck will be appropriated for engine and freight, the upper deck for passengers; the cabins will be 16 feet wide, with an outer guard on each side 4 feet wide; the ladies' cabin will be 18 feet long; the main cabin will be 33 feet; the office and pantry 6 feet; and the room for crew and deck passengers 30 feet, with a guard in front. The engine will be of common construction; the boilers will be placed near the middle of the main bearing part of the hull. There will be two boilers, 40 inches diameter, 19 feet long; two flues, each, 15 inches in diameter; the cylinder will be 16 inches diameter, with 4½ feet stroke of piston: it will have a slide valve and puppet cut off. The water wheels will be 13 feet in diameter, with a bucket 6 feet long.

New Steamboat.—We copy from the "Troy Budget" an account of another invention, which report says will supersede Mr. Burden's. We have sent to the inventor, requesting him to furnish drawings and descriptions of his plans, and hope shortly to be able to lay them before our readers. It consists, we understand, of two boats, and a third may be added—300 feet long, and decked over their whole length. Each boat, in shape and mould very much like the Indian bark canoe, is firmly secured by arches attached to the bottom and passing up through the deck, about 20 feet high in the centre, extending nearly the whole length of the boat. The appearance of the boat is pleasing, and is acknowledged by competent practical scientific judges to be far superior to any thing yet in the shape of a steamboat. Mr. Langdon intends to finish the boat in a superior style, with two cabins of 200 feet each, dispensing with the promenade deck and every thing necessary for its support. On the main deck, the only one required, he also intends to have two horizontal engines, one each end of the shafts, the cranks being placed at right angles. The boiler will be constructed like the one which is in operation at the steam-engine works of Langdon, Grosbeck & Co., West Troy, for burning anthracite coal. The boiler is very economical in its consumption of fuel, and is a rapid generator of steam. Mr. L. is of opinion that one firing will be sufficient to carry his boat from Troy to New-York. We have seen the boiler, and it certainly appears, like the boat, to be superior to every thing of the kind in the country.

The boat is an interesting and ingenious specimen of mechanism, combining great strength and durability, with a spacious deck and extensive cabins. Its buoyancy and dimensions, united with the perfect safety attending it, together with the superior accommodations which can be furnished, when put in operation, will bring about a new era in the history of travelling by steam. Mr. L. has secured a patent, and intends to have his boat in readiness for use in the course of the next summer.

Mr. Langdon is not unknown to the public as a worthy and skilful mechanic. He is the inventor of the Horse Ferry Boat, which has come into very general use. We wish him the completest success in his new enterprise.

Another Steamboat.—This is emphatically an age of steam inventions. New steamboats, steam-boilers, and steam-engines, greet us on every hand; and in this neighborhood there seems to be an astonishing fecundity in this respect.

Mr. Burden's wonder was long ago duly announced, and intelligence of it has been carried by the four winds to the four quarters of the globe. Not long since, some unknown friend sent us a paper printed in Ireland, containing an account of Mr. Burden's invention, originally given in this paper.

We have also noticed, upon the authority of others, Mr. Langdon's invention, and owe him an apology (which we find in the multiplied duties of the conductor of a daily paper), that we have not yet embraced his invitation to examine his boat.

Our object now is, as chroniclers in this region, to inform the public of another invention or model of a steamboat, which, being exhibited in this city, we had the pleasure of seeing on Tuesday. The plan is approved of by several prominent individuals in this city, who, besides, are connected with the present steamboat association, and who, we understand, design, (such is their confidence of its merits,) at no distant day, to reduce the invention to the test of experiment.

The model, which is remarkable for its simplicity and the absence of *extra* and unnecessary incumbrances, represents a boat 250 feet long, and 50 feet wide, composed or built upon two hulls (each 250 feet long) lying parallel to each other, and 20 feet apart in the centre.

The hulls are designed to be 10 feet deep, and 11 wide, with perpendicular sides, so that, at the same time they serve to buoy the boat, they supply two long and spacious cabins; which being below and not above the deck, will obviate the hindrances to speed, which boats having their cabins and a load of fixtures on deck, in certain states of wind and weather, sometimes experience.

The deck is arched, and in such a way, if not to present the full resistance and power of the perfect arch to the weight that may be placed upon it, yet so as in a great degree to strengthen the boat, and render it fully adequate to the uses for which it is designed.

The sides and bottom of the hulls, where they come in contact with the water, are constructed on a line purely designed to diminish resistance, and forming the segment of a circle of an immense diameter.

The boat is to be propelled by a single paddle-wheel of great power, revolving in the centre between the hulls.

The inventor is a young man of this city, of promise and ingenuity, and the present evidence of it is not the first the public has to judge from. His profession and calling have given him opportunies of observation, and of studying the subject of improvements in the application and use of steam and steamboats, which few others have had, and which, with a laudable ambition, he has endeavored to improve for the benefit of the public, and we hope of himself also.

It is also intended to introduce a coal-boiler, constructed on a new principle, the effect of which, it is assumed by those acquainted with the subject, (which we profess not to be,) will be the saving of at least 50 per cent. in the expense of fuel.

To construct a boat 250 feet long, it is estimated will cost $30,000.

The hulls will be framed upon light but strong timbers, upon which are to be fastened successive layers of thin tough oak plank, or boards. The first layer to run horizontally lengthwise the boat; the second crosswise; the third crosswise diagonally; and the fourth lengthwise; the whole fastened or riveted together, by iron nails or rivets, and to constitute a thickness not exceeding four inches: forming, in short, a kind of medium between boats built on the plan of Mr Annesley and common boat building.—[Troy Press.]

Important Discovery.—A gentleman in this town believes he has discovered important improvements on the Burdenian plan of constructing steamboats, which he conceives will eventually supersede every other mode now in use. The improvements, it is thought, will combine every advantage of the Burden plan as to speed, and 1st, a great increase of strength—2d, a much less draft of water—3d, an adaptation to lake or river navigation, in deep, shallow, calm, rapid, or rough water—4th, an adaptation to the conveyance of passengers, or both freight and passengers, affording abundant room for the stowage of freight, which Mr. Burden's plan does not embrace—5th, an increased facility in turning round—6th, a great diminution of cost in the construction. It is supposed that a boat on this plan may be built, which will run as fast as the boat built by Mr. Burden, having the same power of engine, and draw not more than one and a half or two feet of water. Should the sanguine expectations entertained of the value of the improvements, upon further consideration, prove well founded, a further notice will probably appear.—[Brockville Recorder.]

From the Montreal Gazette we extract the following:

Norman Bethune, Esq. of this city has obtained letters patent for a new improved principle for building steam-vessels. Of course we are unaware of the exact nature of Mr. Bethune's improvement, but he has stated to us that ever since the completion of the Manchester and Liverpool railroad, his mind had occasionally been engaged in devising some improvement in the speed of steam-vessels, but that owing to his avocations he had not leisure to give much attention to the subject. He had thought of the buoyancy of the cask, but did not discover the application of it until he read a description of Mr. Burden's new boat, which seemed to promise what he had been in search of. But upon carefully examining it, he discovered a great deficiency in safety to the passengers and cargo, in the event of an accident happening to one of the tubes, by striking a piece of floating timber or ice, end on, while under full impetus, which would cause that side to fill almost instantaneously, and the weight on deck would sink it in a few minutes to the bottom; but where the depth of water should be greater than the breadth of her deck, she would fall over on her back. To obviate such a risk has for the last four months been his study, and he has, in his opinion, happily arrived at a complete safeguard against such an accident; and in attaining that desirable end, his boat naturally acquires greater buoyancy, and of course greater speed.

Mr. Bethune feels perfectly satisfied that a vessel built on his plan will make the passage to Quebec in eight hours, and return in ten, stoppages included. Should his views prove correct, two boats, built upon the new plan, would form a daily line, and starting at six o'clock in the morning from both places, the Montreal boat would land her passengers at Quebec at two o'clock, and the Quebec boat hers at Montreal at four o'clock in the afternoon, (taking the tide as it might happen to be,) and always in day-light.

New Method of applying Steam Power.—Mr. Brown, of Keeseville, has stated that he has invented a plan by which he proposes to dispense altogether with the use of an engine, thereby not only saving the important item of fifteen thousand dollars in the expense, but moreover the cumbrous bulk and ponderous transportation of an engine. He has entire confidence in the perfection and utility of this discovery, having tried the experiment "on a small scale;" and is taking measures to patent his invention, and to demonstrate its capacity early the coming season. Mr. Brown is an ingenious mechanic and worthy citizen of our village. Thus, with Burden's boat, Rutter's process of generating steam, and Brown's application of its power, we may soon expect to ride from Troy to New-York and back in *twelve* hours, and at an expense less than we could stay at home in "these hard times."—[Keeseville Argus.]

Mr. Burden's Steamboat.—In the description of Mr. Burden's experimental boat, (see Vol. II., p. 308,) we stated that the boilers were made under the direction of Dr. Nott. We since learn that they were constructed on the principle of the locomotive boiler in common use, under the direction of Mr. Hall, engineer, of the West-Point Foundry. In these boilers the *flame* passes through a number of small copper tubes, while in Dr. Nott's boilers the water circulates through the tubes. We also understand the latter plan will be shortly tested in a new boat for the Jersey ferry, when its comparative merits will be ascertained.

Steam-Carriages on Common Roads; with a Notice of the Journey to Stoney Stratford. [From the Repertory of Arts.]

We are not disappointed in the expectations we hold out, that "steam-carriages might soon be expected on our common roads," a company being now formed for improving the roads, and running steam-carriages between London, Birmingham, Liverpool, and Holyhead: to be called the "London, Holyhead, and Liverpool Steam-Coach and Road Company," Consulting Engineer, Thomas Telford, Esq., Acting Engineer, John Macneill, Esquire.

From the moment that Sir Charles Dance introduced his carriage to Messrs. Maudslay and Field—and those gentlemen saw enough to induce them to undertake to make repairs and changes in the practical details—we were satisfied that the day was not far distant when this description of conveyance would become general; and it only required that the old carriage should be vamped up sufficiently to perform a journey of some extent, carrying such parties as could duly appreciate the performance; and who, from their practical experience, would judge whether sufficient had been done to justify them in lending their characters in the future advancement of this important project. The Brighton journey, from the admirable manner in which it was performed, naturally turned the attention of scientific men to the subject; and the regular running of the carriage between London and Greenwich for eight successive days (Sundays excepted), added to the general feeling, that enough had been accomplished to warrant that more decided steps should be taken to advance the introduction of steam conveyance on our common roads. Hence it was proposed by a number of influential individuals, that a further trial should be made of the engine, with a view to forming a company between London and Holyhead, should Mr. Telford and other engineers be of opinion that the application of steam on common roads had become practicable; and a proposition was made to Sir Charles Dance, that his steam-coach should run to Birmingham. We have already expressed our opinion that the carriage had performed more than could have been expected, from the inequality of many of its parts; and it would probably (as far as the public opinion was concerned) have been desirable not again to have put the carriage on the road; this was the opinion of many, particularly of Sir Charles Dance himself. The liberal manner however in which Mr. Telford and other engineers and scientific men had taken up the matter, and had tendered their talent to bring the carriage before the public, at once induced Sir Charles to give his approbation to the journey, more particularly as the engineers gave it as their opinion, that although they might not arrive at Birmingham, owing to the state of the carriage, together with the badness of some parts of the roads, they would be equally well able to form a decided opinion from what the present carriage was capable of performing, as to what more might be ex-

pected from a new carriage built by practical workmen, and with due attention to the proper distribution of strength. The question to be decided was, whether the principle was good; if, after a fair trial, the answer should be in the affirmative, then there would be no doubt that, placed in practical hands, engines would be produced capable of performing with as much certainty as any other means of conveyance, and with an increased degree of speed and safety: on the other hand, should the opinion prove unfavorable, and the principle be considered defective, this knowledge must have determined Sir Charles Dance on abandoning all further attempts to realize his great undertaking. Having given these introductory remarks, we cannot but express our pleasure in recording the liberal manner in which the engineers and other scientific men have come forward to advance so great a national undertaking, and by their characters and talent have given weight to the cause in which Sir Charles has so long, so arduously, and we may now add, so successfully labored. We are happy in being able thus to state, that the question of the practicability of steam conveyance on our present roads is now set at rest; because we are aware that many and various reports have gone abroad with respect to the Birmingham trip; but we doubt not that the results which we have given will show, that what was performed on that day convinced all parties present that enough had been done.

We will conclude our notice of this subject, by giving a few particulars of the journey of the steam carriage from London to Stoney Stratford, taken from the note book of one of the gentlemen present. "On Friday, the first of November, 1833, Sir Charles Dance's steam carriage started from Gray's Inn Road, at about twenty minutes after three o'clock, A. M., passing through Highgate Archway, arrived at the Wellington (between five and six miles) in thirty-three minutes, the road being on the rise all the way. At this place coke and water were taken in. When again about to start, it was discovered that the weld at the joint of one of the tubes had given way, and that the water was flowing copiously; the carriage was run into the yard, and the fire put out, in order to repair the defect. Mr. Field, on examination, directed the man to cut out the defective part, and plug the ends; this was a work of time, owing to the want of tools. The object however was accomplished, and after four hours' delay the fire was again lighted, and the carriage once more took the road, and without further accident arrived at Stoney Stratford, fifty-two miles; at which place it was determined to dine and stay the night, and proceed forward next day to Birmingham. In the morning, on lighting the fire, it was discovered that the pipe was still defective, and would require to be removed, that good joints might be made; this must necessarily cause delay. On a conversation of the parties it was generally agreed, *that the practicability and economy of employing steam carriages as a means of transport for passengers on turnpike roads was fully established.* The carriage remained at Stoney Stratford on Sunday, and was to have returned to town on Monday; but there being a meeting of magistrates and commissioners of public works on that day, who expressed a desire of seeing the performance of the carriage, it was determined to delay the return till Tuesday, on which day it came to town, a distance of fifty-two miles, in four hours and forty-five minutes, even with the bad state of the roads.

"We have with pleasure spoken of the liberality of one party of individuals, we cannot pass over in silence the illiberality of others. Immediately on its being determined that the steam carriage should go to Birmingham, Mr. Macneill (one of the engineers of the Holyhead roads), assisted by Mr. Gordon, undertook to make arrangements for supplies of coke and water at proper distances; by this means it soon became generally known that the carriage was expected; and in addition to the already bad state of this portion of the roads (the St. Alban's trust), soft gravel to the depth of ten inches was laid over many parts, with a view to stop the carriage; but we leave this disgraceful conduct to receive its proper notice in the annual report to government of the commissioners and engineers of the roads. With the exception of this trust, the most liberal feeling was displayed by all parties and every facility afforded."

One of the principal roads having thus been taken up, and countenanced by some of our most celebrated engineers, leaves no doubt that attention will soon be called to other roads. An important benefit attending improving the present roads is, that the course of the traffic will remain unaltered; and thus the immense interests embraced on the "road sides," throughout the country, will retain and perhaps increase their value.

The subject of road making becoming thus a matter of the greatest importance, we hope to be able to give some particulars of the improvements which have been judiciously made on the Holyhead road; and we shall be happy to receive any information on this

subject from our correspondents; for we are anxious to see every possible improvement introduced in our means of conveyance, whether on canals, railways, or common roads; we are advocates for all, for each means has its advantages; and we do not hesitate to say, that England is as much indebted for her prosperity to the facility of conveying her produce, as to any part of her economy.

Since writing the above, we have been favored with a copy of the report of the engineers who accompanied the carriage, which we subjoin.

Report of the Result of an Experimental Journey upon the Mail-Coach Line of the Holyhead Road, in Lieutenant Colonel Sir Charles Dance's Steam Carriage, on the 1st November, 1833.

Public attention having been attracted to the practicability of travelling with locomotive engines upon ordinary turnpike roads, by a report of a Committee of the House of Commons, of the 12th of October, 1831, stating that, in the opinion of the committee, the practicability of such mode of travelling had been fully established; and more recently by a report of a journey to and from Brighton having been successfully performed by Lieutenant Colonel Sir Charles Dance's steam carriage, as well as by the fact that the same carriage was daily in use between London and Greenwich, conveying numerous passengers through the crowded suburbs of the metropolis without the slightest inconvenience to the public, we were desirous of personally making an experiment of the facility with which a carriage of that description could perform a journey of considerable length; and having selected the mail coach line of the Holyhead road for the purpose of such experiment, we made an arrangement with Sir Charles Dance for the use of his Carriage, on Friday, the 1st inst.

*The weight of the carriage, with the water, coke, and three persons upon it, was about - - - - -	3 tons, 5 cwt.
The weight of the omnibus coach attached to it -	1 " 0 "
The weight of the passengers, their luggage, and some additional sacks of coke, about	1 " 15 "
Making the gross weight moved,	6 tons, 0 cwt.

The motive power was an engine with two cylinders, seven inches in diameter and sixteen inches stroke. The pressure of steam on the tubes constituting the boiler, or generator, was not allowed to exceed 100 lbs. per square inch.

Before the carriage had proceeded six miles, one of the tubes of which Sir Charles Dance's boiler is composed was found to leak so fast as to render repair absolutely necessary: it was also apparent, that the size of the engine was not sufficient to carry so great a weight along a heavy road at any high velocity.

The weather was by no means favorable, there having been much rain in the course of the night and morning, so as to make the road heavy, added to which the winter coating of new materials had, in many places, been laid upon the road. Notwithstanding these obstacles, upon our arrival at Stoney Stratford, 52½ miles from town, it was found by Messrs. Macneill and Carpmael, who had taken accurate minutes of the loss of time occasioned by stoppages, that the average rate of travelling had been seven miles per hour.

Thus there can be no doubt, that with a well constructed engine of greater power, a steam carriage conveyance between London and Birmingham, at a velocity unattainable by horses, and limited only by safety, might be maintained; and it is our conviction that such a project might be undertaken with great advantage to the public, more particularly if, as might obviously be the case, without interfering with the general use of the road, a portion of it were to be prepared and kept in a state most suitable for travelling in locomotive steam carriages.

Thomas Telford, President of the Society of Civil Engineers.
John Rickman, Secretary and Commissioner of Highland Roads and Bridges.
C. W. Pasley, Lieut. Col. Commanding the Royal Engineers, Chatham.
Bryan Donkin, Civil Engineer.
Timothy Bramah, Civil Engineer.
John Thomas, Civil Engineer.
Joshua Field, Civil Engineer.
John Macneill, Engineer to the Holyhead Roads.
Alex. Gordon, Civil Engineer.
Wm. Carpmael, Civil Engineer.
J. Simpson, Engineer to the Chelsea Water-Works.

London, November, 1833.

We shall now subjoin a list of locomotive engines, completed and building in England, taken from the report of the committee appointed by the British Parliament.

* These facts have been ascertained by Mr. Joshua Field, Mr. John Macneill, and Mr. Alexander Gordon, civil engineers.

Locomotive Engines—Historical Retrospect. Compiled from the Report of the Committee of the House of Commons, of August, 1831.

The first locomotive engine was invented twenty-eight years ago, by the late Mr. Trevithick, a very ingenious man, and subsequently improved and used by Mr. Blenkinsop and others, for the service of collieries.

Mr. Gurney stated that his carriage weighed only 2½ tons; that in 1825 he began to work it; that in 1826 he went up Highgate and other hills; and in 1827 he went to Bath.
that he has run 18 to 20 miles an hour.
that he is able to compete with the coaches, with an advantage, as 2*l.* 10*s.* to 15*s.* per hundred miles.
that he makes no noise.
N. B.—Mr. G. run his carriage for some time between Cheltenham and Gloucester, to the great loss of his supporters, Sir Charles Dance and others.

Mr. Hancock stated that his carriage weighed 3½ tons, that, with a piston of 9 inches, he has worked at 400 lbs., and on an average at from 60 to 100 lbs. on the square inch; consequently, could exert a power of 13 to 90 horses.
that he makes only one-third of the noise of others.

Mr. Farey stated that Mr. Hancock and the Messrs. Heaton were the only candidates likely to prove successful.
suggested that there should be 2 horses at every hill, for the help of these locomotives.
stated that passengers were annoyed from heat, noise, smoke, and dust.
condemns Gurney's, &c.
N. B.—The Messrs. Heaton, residing at Birmingham, were not examined.

Mr. Ogle stated that his engine is 20 horse power, with a pressure of 250 lbs. on the square inch.
that his carriage weighs 3 tons.
has gone at the rate of 32 to 40 miles per hour —and has ascended hills at the rate of 16½ miles per hour.
explosion impossible.
he is on the point of establishing a factory, *so great are the demands for his carriage!*

Mr. Gibbs was very sanguine in his hopes of success —proposed to plough, and drive vans.

Mr. Summers (the partner of Mr. Ogle) stated that they had constructed 2 carriages, weighing 3½ tons, besides passengers.
that they had carried 9 persons at the rate of 9 miles, when the crank broke, and the carriage was sent back by canal.
has carried 19 persons at the rate of 10 miles.
has travelled at the rate of 30 miles during 4½ hours frequently; consequently 135 miles in 4½ hours.*
has ascended Shirley-hill, which is 1 foot in 6.

Such was the state of the locomotives in 1831.

Observations.—In 1833, Mr. Gurney, the most persevering of all the competitors, is beaten out of the field, to his great cost.

Sir Charles Dance, his substitute, has run many times to Croydon and Greenwich—made an attempt to go to Birmingham, in which he failed—and made, lastly, an attempt to run daily to Clapham, in which also he has failed.

Messrs. Hancock, Ogle, Gibbs, Summers, and Heaton, are all in movement, but merely by convulsive starts; although they are provided with powers that may be raised to twenty, thirty, forty, and eighty horse power.

About twenty years have passed away in experiments, and not less, probably, than 100,000*l.* have been expended upon them; yet, after all, nothing effectual has been done.

At one period steam guns were the terror of many: they were to have mowed down whole ranks of infantry and cavalry; even artillery were to be quite impotent before them; but nobody now hears or dreams of such things. It would almost seem as if steam-carriages were destined to run the same course. The writer hopes not; but if he were to look for grounds to anticipate a different result, it would not be in any of the prospectuses for steam-carriage companies that he has seen, of which the best that can be said is, that they circulate much easier than the wheels of the carriages that they respectively extol to the skies.

A Frenchman.

List of Steam-Coaches and Drags now building and built in London and its Vicinity.

We have been favored with this list by a correspondent, who states that its "accuracy may be depended on." We really had no idea that there were so *many* locomotive competitors in the field.—[Ed. M. M.]

Hancock	1	Infant, his own, built, experimental one.
Ditto	2	Era, (for a company,) built.
Ditto	3	Enterprise, (ditto,) built.
Ditto	4	Autopsy, his own, built.
Ditto	5	a new one now building, his own
Gurney, Maudsley, Stone, and Gibbs	1	a drag, built and altered by the said engineers, for Sir C. Dance, Knight.
Ogle	1	a carriage, his own, built, experimental one.
Squire	1	a carriage, himself and others, experimental one.
Frazer	1	a carriage, himself and others, building, experimental one.
Gibbs & Applegath	1	a drag, themselves, experimental one, built.
Gatfield and Bower	1	a drag, themselves, experimental one, building.
Andrew Smith	1	a drag, (for Mr. King,) experimental one, building.
Palmer	1	a drag, his own, experimental one, built.
Redmund	1	a carriage, experimental one, building.
Manting, Joseph,	1	a carriage, his own, experimental one, building.
Phillips & Co.	1	a carriage, their own, experimental one, building.
Silk	1	a carriage, his own, experimental one, building.
Smith and Co.	1	a carriage, (for company,) experimental one, building.
Mile-end, (name not known)	1	a carriage, (for a company,) experimental one, building.

The application of steam to agricultural purposes is said to have lately called forth a powerful and effective engine in France; and it has at the same time produced a steam digging machine in England.

* Mr. Summers afterwards explained that what he meant to say was, that he had travelled "for the space of four *miles* and a half—not four *hours* and a half—at the rate of thirty miles an hour."—[Ed. M. M.]